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FOREST BELT'S

Easi-Guide to ACCESSORIES for ...CB ...TWO-WAY ...HAM RADIO

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Franklin C.
Bergquist

Forest Belt's

Easi-Guide

to

ACCESSORIES FOR
. . . CB
. . . TWO-WAY
. . . HAM RADIO

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Introduction

Suppose you're a two-way radio buff who already has a top-grade communications outfit. What do you do for an encore? Whether you're a ham, commercial two-way radio user, or one of 7 1/2 million CB radio enthusiasts, sooner or later you begin to experience a vague restlessness. Your unease translates eventually into an urge for something new or different from—but definitely better than—the system you have. Often, your only relief derives from frequent trips by the nearest communications store. That would be okay if the outfit you have were not adequate. But it is, and your therapy could prove costly—both at the store and at home.

Perhaps you need another approach. You're probably ready for the ACCESSORIES road to improvement. It could prove just as satisfactory, and far more economical. Certainly it's worth a long, sober look at the ways you can build up the radio system you have. The pages that follow guide you through that sort of examination. You'll see what various accessories can do and how each kind fits best into your particular situation.

You don't want to rush out and buy accessories haphazardly. That's wasteful. Worse, it leads to a hodge-podge radio system that doesn't really have the look or touch of professionalism.

The thing to do is sit down and engage in a little planning. Read through the chapters that tell you what special microphones and antennas, extra speakers, rotators, and the like actually do for you in terms of communications. Decide what would truly enhance your base setup, or your mobiles. Maybe you do need some new transceiver equipment, but not before you've explored how to make the best use of it through wisely selected accessories.

My coauthor, MARTI McPHERSON, and I have detailed for you an extensive collection of accessories. Some, we feel benefit your two-way communications directly. Others, we feel you ought to know about, because of misunderstandings that circulate—particularly in nontechnical CB and commercial circles. Certain items, you really need—to upgrade the quality of communications among your base and mobile units, and with other stations, where that's permissible (CB and ham).

We also devote many pages to the subject that's omitted from other books about accessories: Just how do you use accessories once you've bought them? You'll find extensive photo studies that SHOW you how, and concise explanations that TELL.

Many people contributed in many ways to making this book thorough and accurate. For extraordinary help, we thank Paul Jeffrey Delk, Carl Daniel Delk, Larry A. Belt, Dustin Teel, Mr. Radio of Indiana, Ron Carrol, Alice and Verne Tetrick, Eugene A. Wilson, Steve McPherson, Andrew Thompson, Rick Sanderson, and Robert Bowman. Some 35 companies loaned materials for photography, too many to name individually here. Some, however, were especially cooperative in this and other ways: Antenna Specialists, Cobra Communications, GC Electronics, HarCor International, Littelfuse, Magitran Co., New/Era Sales (Indianapolis), Bernard Bathauer of Mobile Marine Electronics (also Indianapolis), Gold Line Corp., and Cornell-Dubilier Electronics.

These companies and individuals—and we in the Forest Belt writer/photographer group—wish you many fruitful hours of accessory use, knowing these products and efforts can enhance your two-way radio system and bring you better communications.

Forest H. Belt

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CHAPTER 1

Add-Ons Upgrade Your Two-Way Radio

At last, you can now conduct your own personal communications by radio. On land, on sea and on inland waterways, and in the air, two-way radio not only provides necessary communication, but finds you new friends as well.

Yes, owning a transmitter-receiver outfit opens countless doors. In business, you can take important messages even though you're miles from a telephone. At home, you can keep track of family members in their cars, or chew the fat with other two-way radio buffs. On the road, you can learn exactly what's ahead—accidents, poor road conditions, repair zones, bad weather, highway patrols. Such information often saves you time, aggravation, and perhaps gasoline.

For the hobbyist, Amateur Radio ("ham" radio to most of us) offers even more. While most personal two-way communications are limited to a radius seldom more than 30 miles, amateur radio contacts can reach around the world.

Ordinarily, a two-way system does not end with a simple transmitter and receiver. Whether your personal communications interest lies in Citizen Radio (CB), Business Radio (BRS), Amateur Radio (ARS), or Marine Radio (MRS), you find one thing in common with all the others: accessories. You'll want to add accessories to your system, you can almost bet on it. Choosing and using them to improve quality and dependability of your two-way communications—that's what this book is all about.

The basic units of a two-way radio system—transmitter, receiver, and power supply—typically fit into one package, called a transceiver. Primary accessories are microphone and antenna. With these items alone, you can communicate adequately.

Some two-way radio users never go beyond basic equipment because that fills their communication needs. Other two-way systems go unadorned because newcomers, such as many CBers, don't really know what accessories could do for them. Business and Industrial Radio systems don't have too many accesories available; too, a company may decide it's too expensive to accessorize all their units.

But a lot of two-way radio operators, especially those who look on communications more or less as a hobby, want (and can use) more versatility. And turning a plain two-way radio installation into a fancy station calls for accessory equipment. Accessories meet a variety of purposes. Some expand usefulness, others extend equipment life, and many improve reception and transmission. Note: Illegal power-boosting equipment won't do any of these. In fact, where power is limited (such as the 4 watts output of CB), illegal equipment can create problems. You'll see why, in detail, later.

But meanwhile, realize that you don't have to settle for bare necessities. You can upgrade any kind of two-way radio system. Sometimes adding certain accessories almost doubles as a do-it-yourself repair.

When you put your two-way station in a motor vehicle, size of the vehicle may dictate how many and what accessories you can add. For example, in a compact or sports car, you may have trouble finding space for the transceiver. It may take considerable thought to find space for extras as well. Auxiliary speakers in the doors might offer better sound. A ground-plane kit overcomes the antenna problem presented by a fiberglass auto body.

You find more room in a van or truck. You might add an in-line vswr meter, or an antenna matcher. Easy-release mounting brackets, quick wiring disconnects, PA speakers, burglar alarms—all upgrade or protect your radio.

If you own a big recreational vehicle, you'll want add-on speakers in the back, and probably outside. When you're parked, convert your dc-operated mobile radio to a base by combining it with a 12-volt power supply that operates from 117 volts ac.

Other accessories combat serious difficulties. For example, one thing all mobile communication installations have in common—to one degree or another—is interference. Just starting your car or truck can create popping sounds in your radio. Nearby vehicles with high-energy ignition cause unwanted radio noise. So can movement of your vehicle's body against the frame, your car heater or air conditioner motor, alternator, generator, voltage regulator—just about any appliance for your vehicle could interfere with the reception side of your two-way conversations. You reduce those bothersome noises with filters or noise supressors. Read how, where, and when in Chapter 8.

Other accessories deserve equal attention. Microphones star in Chapter 2. Speakers you'll learn about in Chapter 3. Be sure to read Chapter 4, on cables and connectors; you'll see what we mean about do-it-yourself repairs. A whole wealth of general mobile accessories take over Chapter 7. You'll see easily how and why certain accessory products claim so much attention from serious two-way radio users.

So much for accessories to soup up your mobile installation. What about base stations? That's easy. Leaf through any electronics catalog or visit your local two-way radio shop. You'll discover an endless variety of antennas, microphones, power amplifiers, meters, antenna switches—and much, much more. It's difficult and unnecessary to put all this extra equipment in a mobile. But at your base station, it's another story. You can find both room and reason to upgrade your outfit to your heart's content.

Having set up a basic station, you may want some performance indicators—like vswr meters, in-line wattmeters, and so forth. You might want or need a desk-type microphone rather than the hand-held mike that usually comes with a base transceiver. You might like the performance and sound from an amplified mike. If your base sits in a noisy location, your voice messages will be more intelligible if you use a noise-canceling mike. If distance looms important to your communications, you need a tall tower and a beam antenna.

However, slow down a minute. You don't just slap a bunch of things together. There are ways to manage this upgrading so you're sure of improved performance. The suggestions in this book are not the only ways to build a better two-way radio station. But experience has proved that the methods and accessories shown here do benefit performance. We see no point in your spending the money and time, otherwise.

Some simple two-way radio accessories just fasten onto or into your radio system. But in more cases than not, you'll require some tools. The smart operator always keeps a few spare parts around too—like antenna connectors and fuses.

When getting down to the nuts and bolts, think metric. Many —more like most—two-way radio accessories are manufactured in Asia. They use the metric system. So buy a set of metric wrenches or a ratchet and socket set. Some sets cost as little as $10.

If you're serious about two-way radio, equip yourself with the few tools needed to do it right. Start with a box of single-edge razor blades. Follow that with four kinds of pliers: slip-joint gas pliers, Channel-locks, diagonal cutters, and a pointed-nose pair. Add a regular-size screwdriver, a stubby with medium-size bit, and one with a tiny bit. You'll need a couple of Phillips screwdriver sizes, and an assortment of hex nutdrivers. If Allen wrenches came with any of your radio equipment or antennas—drop them into your tool kit too.

So you can repair wires and cables, pick a crimping tool that has wire cutter, wire stripper, and crimping tool all in one. You'll use this tool for adding quick-disconnect plugs, to install lugs for various hookups, and for other cable wiring. Carry a variety of crimp-on wire lugs. Keep crimp-type splicer connectors in your tool kit. Stick cable ties and rubber grommets in your kit to protect and dress up cable runs.

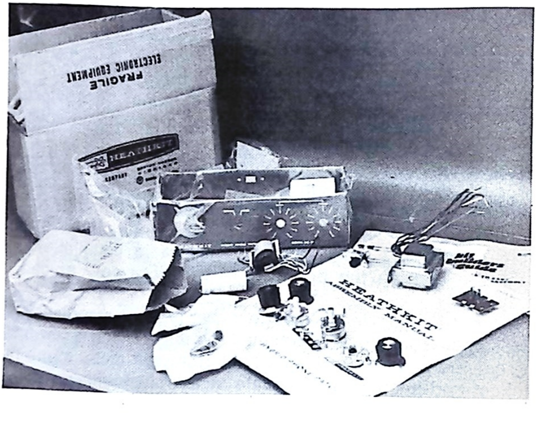
A cordless, rechargeable-battery soldering iron is a convenience not to be overlooked. Soldered connections—on cables, mounting brackets, and elsewhere—hold up best. And don't forget solder, rosin-core of course. If you operate mobile very much, consider a spare pre-packaged radio installation kit. You'll see later in the book where this accessory comes in handy.

Last, but far from least, include a vswr (voltage standing wave ratio) meter (sometimes nicknamed swr meter). Only a few base transceivers have a vswr meter built in. A vswr meter offers the quickest and best way to evaluate radio system efficiency.

If you're into radio electronics as a hobby or use electronics in your work, you might want to build some of your own two-way radio accessories. Amateurs often design and build a lot of their add-on equipment. However, you need a great deal of technical know-how to do it right.

For those less technically inclined, there's *Heathkit.* This company sells several build-it-yourself two-way radio accessories as well as amateur radio kits. Any Heathkit comes complete—all parts and instructions. If you have the tools outlined on page 11, you're set to construct whatever add-on your heart desires—phone patch, two-meter amplifier, encoder, heavy-duty power supply, vfo (variable frequency oscillator), linear amplifier, speaker, coaxial switch, vhf wattmeter, or dummy load.

You'll have fun building accessories. You'll learn a lot about electronics . . . things you'll find helpful toward understanding your two-way radio outfit and how it works.



CHAPTER 2

An End to Shouting—Microphones and Mike Accessories

No matter how top-rated or expensive your transceiver and antenna, you still won't reach out with a faulty or inadequate microphone.

It's no secret that some transceivers come with mikes that don't do justice to the modulation. But aside from that, the original mike in a radio system can wear out. Screws work loose; push-to-talk buttons become sticky or squeaky; elements lose their pizzazz. Mike cables wear out—leaving, at best, intermittent transmission. Or, you could want a new mike simply to upgrade your equipment. That's a good enough reason.

Replacement mikes are readily available. The variety of possibilities, from simple dynamic hand mikes to amplified and noise-canceling base mikes, can leave you confused when you start shopping. So in this chapter, we'll try first to help you select the microphone that suits your needs. Then we'll show how you install it.

Suppose people you communicate with complain that your voice on the air sounds weak. How you speak into your mike could cause that problem. Each type of microphone requires its own technique.

Take, for example, the hand mike with your mobile radio. Don't jam it in front of your mouth. You'll muffle the sound of your voice, and your breath will add unwanted "mush." If you're too close, either you overmodulate the transmitter (illegal and unnecessary), or your tones get clipped by the transceiver's built-in modulation limiter. Either way, to those listening at a receiver, your voice comes through mushy and garbled. Instead, hold the hand mike close to the corner of your mouth, and to one side. Speak *across* the mike. Keep the sound of your voice at a level about as if you were speaking across the dinner table.

Set desk mikes 12 to 18 inches away from you. It's better not to pick them up; your hand causes unwanted noises. Face the mike head squarely and talk into it—or aim slightly over the top of it. Again, talking too close to the mike or too loud, causes mushy modulation. If you're too far away from the mike, you'll sound weak or as if you're in a well. That hollow sound comes from the mike picking up room echoes your ear normally ignores.

If neither of these techniques improves the sound of your transmitted voice, determine why not. Maybe your mike is just old and worn out. Could be you need an amplified mike or a speech compressor to suit your particular way of using a microphone. Or perhaps speech pickup suffers because your radio room contains too many noise-making devices. Whatever the cause of your poor modulation, once you identify the problem, you can hunt for a mike or an accessory to correct it.

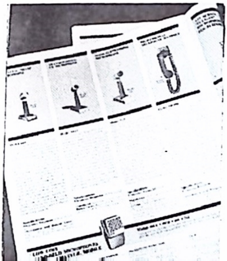
First thing to consider in your mike shopping is the working *element* of whatever type draws your interest. The element is the device which changes voice sound waves into the electrical impulses called a *speech signal.* Mikes for voice communications contain one of three generating element varieties—carbon, ceramic, or dynamic.

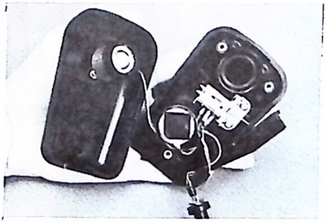
All mike elements have a diaphragm up front. It looks like a round piece of thin, fibrous paper about the size of a quarter. Your voice makes sound waves, which are vibrations in the air. These waves impinge on the diaphragm, which passes them on to the generating element.

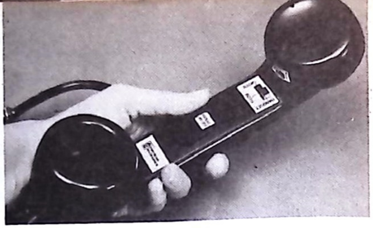
In *carbon* mikes, the generating element behind the diaphragm is a cartridge (called a *button*) of carbon granules. Telephones use a similar element in the mouthpiece. The diaphragm packs and unpacks the carbon granules in step with your voice waves. A voltage traveling through the element becomes stronger and weaker, according to the vibrations, forming the speech signal. Carbon mikes need a stable source of voltage, which makes them unhandy in some applications. But carbon mikes are low-cost, and work adequately for some two-way radio needs.

Ceramic (and crystal) mikes are not as susceptible to weather conditions. However, a ceramic generating element is more fragile than the carbon type. The diaphragm picks up sound waves and transfers their vibrations to a brittle ceramic element. The vibrations twist the ceramic material, generating a voltage that changes in step with your voice waves. The effect is called *piezoelectric,* and in this case the result is the speech signal. Ceramic mirophones deliver clean voice reproduction. As a rule, they cost more than carbon mikes.

Dynamic mikes house the third kind of generating element. Of all three types, dynamic microphone elements are the most reliable. Dynamic mikes pass the sound-wave vibrations from the diaphragm to a coil that is suspended between the two poles of a magnet. When you talk, sound waves move the coil back and forth in the magnetic field. This movement induces a voltage (signal) that corresponds with your voice or speech. Dynamic mikes are usually the most expensive.







Performance does not stop with what's inside the mike. The physical design of a mike often determines its usability in your two-way radio setup.

Hand-held mikes are the most common. You can hang or rest them almost anywhere, and grab them up quickly when you want to talk. But all this mike mobility can be a nuisance at a base or fixed station. Therefore, you might replace the hand mike with a *desk* model, or *base station mike* as it's frequently called. A stand prevents the base or desk mike from getting knocked around or lost under a shuffle of papers.

You may not notice surrounding noises when you're listening to your two-way radio. But when you want to talk back, any sensitive microphone picks up the noise along with your voice. A *handset* microphone (speaker in the earpiece) might be your answer. It circumvents outside noises whether transmitting or receiving. Push-to-talk controls are in the handle, making the handset easy to use.

Then, for the motorist—eighteen-wheeler, four-wheeler, or whatever—for hands-on driving, consider the safety of a *boom headset.* An earpiece carries receiver sound to your ear; a tiny, sensitive dynamic mike swings in front of your mouth by a slim, lightweight boom. A push-to-talk button in the cord can be clipped near the steering wheel. Some models even have VOX (Voice Operated Transmitting) so you never need move your hands from the wheel or the motorcycle handle-grips.

These four microphone designs often sport added features, such as amplifiers, noise canceling, and speech compressors. Details come later in this chapter.

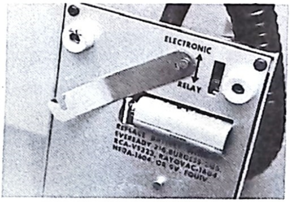
A replacement or accessory mike you select must fit your two-way radio *electronically.* So how do you know whether it does or not? Start with the owner manual for your transceiver. You'll want several bits of information from it.

(1) You need to know what method of *switching* your radio uses for keying from receive to transmit. Some switch electronically. Others transfer by relay. If the mike you like can't be made to work for both, you must buy one that matches your transceiver's switching.

(2) Look up the microphone *output level* your transceiver needs. Let's say your transceiver specs list mike output level at −50 dB. That normally means your transmitter can deliver close to 100 percent modulation with any mike that supplies a −50 dB output. But some specs are optimistic. Suppose other operators report your modulation weak. You try the suggestions on page 14, to no avail. You can probably upgrade your voice communications by finding a mike with a −30 dB or −25 dB output level. (The lower the minus-number, the more the mike output.) However, if you buy a mike with too much gain for your transceiver, you'll only succeed in overmodulating, splattering adjacent frequencies, and garbling your voice transmissions.

(3) You must also match *impedances* of microphone and transceiver. Don't connect a low-impedance dynamic mike to a transceiver with high-impedance mike input. Likewise, don't hook up a high-impedance microphone (ceramic, crystal, or dynamic) to a low-impedance input. Usually, it's easiest to replace the old mike with a new one that has the same type of generating element. But watch dynamic mikes; they come in many different impedances. (Stay within 20 percent.)

Replacement mikes worth having include a chart of transceivers they work well with. Such lists also describe what wires hook to which pins in the mike connector. If your radio isn't listed, buy the mike at your own risk.



Hand-held mikes are by far the most popular style. Because they take so much wear and tear, they need to be replaced more frequently than other styles. Hand mikes develop certain characteristic problems.

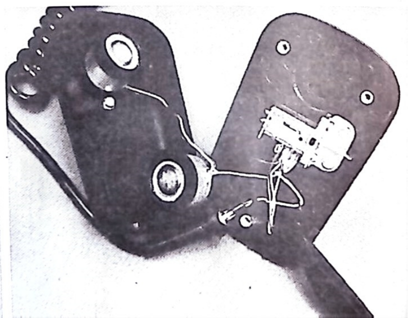
(1) The screws often work loose. That starts the two halves of the mike case rubbing together. Before long, you're transmitting case noises along with your voice. It becomes annoying to those you try to communicate with. Remedy: Tighten the screws. If this doesn't help, replace the mike.

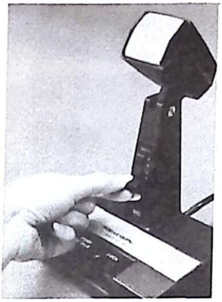
(2) Hand mikes commonly incur problems with the push-to-talk (ptt) lever. A sticky ptt button may only need cleaning. In less expensive mikes, the ptt lever may work loose from the case altogether. Repair probably won't hold up long. A ptt button can get warped (and thus sticky) from too much heat or sun. Or the mike case may warp and bind the button, also causing mechanical sluggishness. Try loosening the top screws a quarter turn. If this doesn't help, take the mike for repair or buy another.

Let's say you need a new hand-held mike. Dig out the technical information discussed on page 17. Then go shopping. If you've had a simple dynamic mike, you may want to step up to an amplified or noise-canceling type.

There's one point too easily ignored in buying hand mikes. You can get so carried away by features that you forget the prime factors of comfort and handling. Your new mike should fit your hand. Not all hand mikes will feel comfortable to you. So try hand mikes for size, just as you would a pair of shoes or a hat. Test the location of the push-to-talk lever or button. You may not like squeezing the talk lever with your fingers when you've been squeezing with your thumb. Be sure you don't have to put your hand over the face of the mike to operate it and hang it up handily.

Shop around. If you don't find a mike that suits you in one store, go to another. With all the brands and models available nowadays, you'll eventually find one that's right for you.





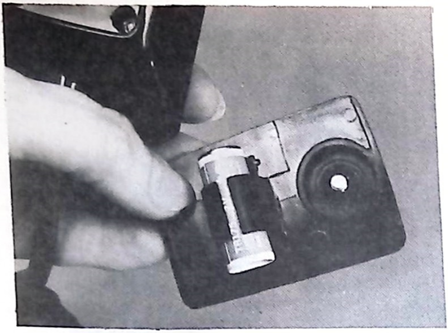
Base or desk microphones ordinarily hold up longer than hand mikes. Therefore, when you go after a new base mike you usually want something extra. Maybe it's a *hold* key for the push-to-talk button. That's handy for lengthy transmission.

Most frequently, two-way radio operators look for amplification in a base mike. Don't be fooled by the term "power mike." Amplified mikes cannot drive your transmitter to more than 100-percent modulation without causing garble and splatter. In reality, the difference between 85 and 100 percent, when you refer to undistorted modulation, is hardly noticeable at the receiving end.

So what good is an amplified mike? For one thing, it boosts the volume of a soft voice. The amplification brings quiet voices up to the full input level your transceiver can handle. However, it's not all roses. As you increase the gain setting for your voice, you're also amplifying background noises, which may not be good. Gain mikes do not get you more miles either, at least not directly. You can be heard better at the outer limits of your transceiver range—providing you don't push modulation beyond 100 percent.

Here's how to operate a "power mike." Knobs or slide controls vary the amount of amplification. Start your transmitting with the control set near the low end. Work higher from there. Let fellow radio operators, listening at their transceivers, guide you to the setting that produces strongest modulation for your voice, with no distortion.

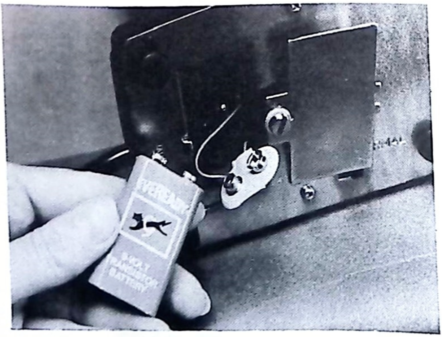
Finally, a strong word of caution. Overamplification causes modulation squeal, distortion, and splatter. These all destroy transmission effectiveness, rather than help it. Take it easy on the controls.



Along with the advantages of amplification comes a complication. An amplified mike needs a battery to power the mike preamplifier. On the average, a battery lasts about six months. Deluxe mikes (*Turner* Expander 500, for example) have a meter to indicate battery strength. But with most, the only way you know it's time for a new battery is when someone says, "Hey, Good Buddy, your carrier's laying big numbers on me, but your modulation sounds far away." When that happens, measure battery voltage as shown on the page opposite.

As you probably know, batteries have a positive (+) and negative (−) side or polarity. The battery *must* be installed correctly. You'll find battery polarity and position stamped inside the battery chamber of some hand mikes. Base models often use a 9-volt battery with connecting cap. You can't cross polarity with this cap; it only snaps onto the battery one way.

Generally speaking, don't buy "sale" batteries. They're usually old. Batteries grow weak just sitting on the shelf (yours or theirs). Buy batteries only as needed, and preferably from a busy electronic parts store. That's your best assurance of getting fresh ones.



You can test any battery's capability if you have a voltmeter or multimeter. Here's how.

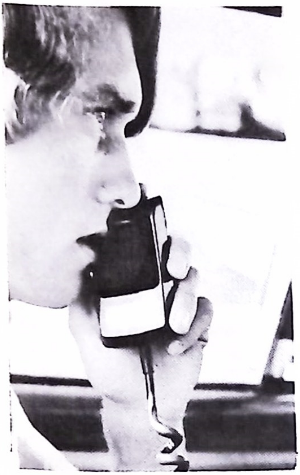
Set your voltmeter for dc measurement. Turn the knob to read at the next level *above* the voltage listed on the battery. Hence, for a 9-volt battery, set your meter at 10, 15, 20, or whatever the next higher full-scale range happens to be.

Open the mike case by removing the screws and lifting off the back of the case of the battery-chamber cover. Leave the battery in the chamber, or at least leave it connected.

Insert the black voltmeter probe to touch the negative (−) end or terminal of the battery and its contact. Touch the red or positive probe in the same manner to the positive (+) battery connection.

Press the mike talk button. Read the meter. If the meter shows more than 10 percent below the voltage printed on the battery jacket, you're losing too much power. Install a fresh battery.

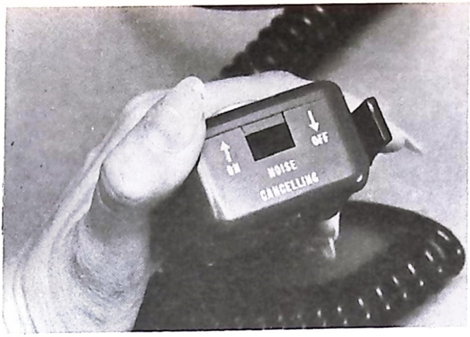
You can make this test while talking with someone. Or, attach a dummy load to the back of your transceiver in place of the antenna—to prevent throwing a useless carrier. Then test. In all, it takes only a few minutes to detect and replace a weak battery, and cure your power-mike modulation problems.



Noise-canceling mikes suppress unwanted background sounds. The diaphragm is placed so it reacts only to sound waves hitting it from directly in front. Any noise waves entering the mike from the sides—such as machinery, traffic, wind, motor or engine noises, surrounding conversation, or music—cross the diaphragm in a manner called *out-of-phase,* and are canceled.

Of course, there's a specific way to talk into a noise-canceling microphone. Noise-suppressing base mikes usually have a cone of wire mesh projecting an inch or so in front of the mike head. At the very front of this mesh is the diaphragm. Unlike with ordinary desk mikes, where you stay a foot or more away, you choke up on this one. Talk with your lips no farther than a half-inch from the screen covering the diaphragm. Speak directly into the mike. Surrounding noises go into the mike behind the diaphragm, between it and the element. Noise waves behind cancel the noise waves in front. Only voice waves, coming from the front, up close, create an electronic signal from the element.

Noise-canceling hand mikes operate just about the same way. Rather than holding these mikes a few inches from the corner of your mouth, put your mouth right up to the lip guard to transmit. Keep your lips within a half-inch of the front.

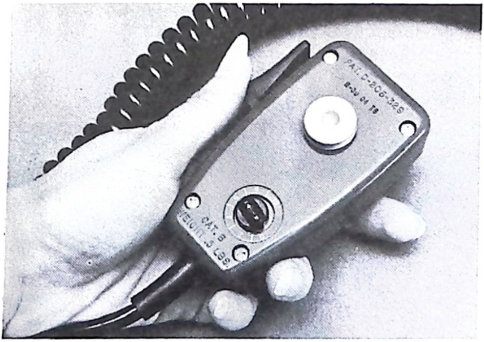


Some noise-canceling mikes offer you an option. When you're not around a lot of noises, switch the noise-canceling feature off. Then talk across the mike as you would with any ordinary desk or hand mike.

Another extra is amplification. Look on the back of hand mikes for a gain control—either a numbered dial or a slide control that goes from LO to HI. As page 19 pointed out, if you have a soft voice, amplification can help—even with noise-canceling mikes. While it supresses surrounding noises, an amplified model emphasizes the sound signals created by your voice. Amplification gives them the added push to reach out with strong, clear modulation.

As with other amplified mikes, you have batteries to contend with every few months. If you doubt the efficiency of your mike, verify battery strength as page 21 shows.

One thing we haven't mentioned thus far about accessory mikes: Most of these mikes come without connectors. Plain mikes have only three or four wires to be connected; noise-canceling or amplified varieties may have five or six. Pages 34 and 35 show you how to go about attaching your new accessory mike to a suitable connector.

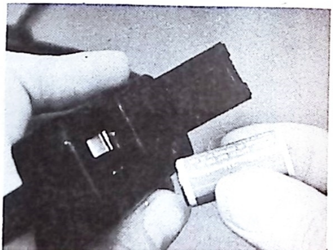


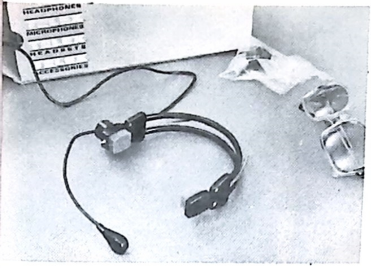
Headset or boom mikes offer a lot: noise-canceling voice pickup and amplification, and listening privacy through an in-the-ear speaker. You hear better because the speaker in your ear helps you sort out radio messages from other noises around you. Other radio operators receive you better because the sensitive boom mike hangs directly in front of your mouth, keeping voice pickup constant and strong.

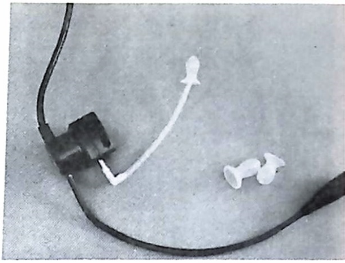
Not everyone—passengers, relief drivers needing sleep, or folks at home—enjoy listening to your two-way radio. Headsets let you hear what's happening on the channels without bothering others. A headset also leaves one ear free to hear other sounds around you—like music, conversation, or sirens.

With some boom-mike headsets, the cable houses a push-to-talk control within a couple feet of the earpiece. Some models allow clipping this switchbox to a lapel, jacket, skirt, or slacks pocket. Hang the switch as near the steering wheel as possible in a mobile. You'll find transmitter control easier. But don't drape the cable where it could interfere with driving.

Amplified headsets usually contain a battery in the switchbox. Pry the battery chamber open with a screwdriver. Note the battery polarity embossed on the chamber lid. Drop a new battery in about every six months, oftener if needed.







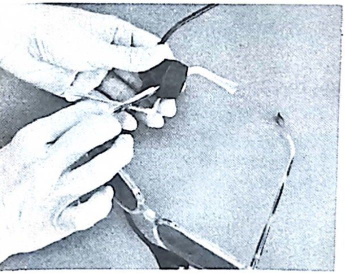
If you don't like the idea of a headband clamped to your skull, consider attaching the earpiece to your sunglasses. Sound like a good idea? Look how easy the *Telex* CB-88 makes this trick.

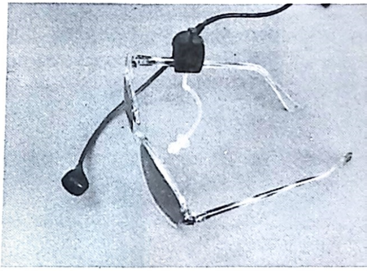
(1) Remove the headband from the mike boom. Tug firmly on the little black cube on the inside of the earpiece.

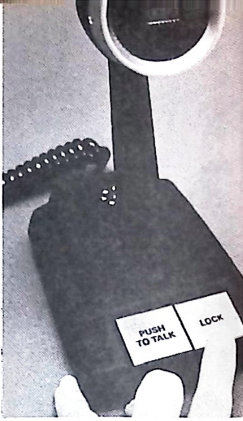
(2) In one little package that comes with this headset, you'll find another little black cube—one with a slot in it. There's also a long black screw. Line up the notches on the cube with those on the earpiece and press firmly. If aligned properly, the two pieces snap together readily.

(3) Notice the cube has a little brass nozzle on the bottom side. Look for another small packet that holds four soft, clear, plastic items. Remove the contents. Pick out the plastic tube with an elbow at one end. Slip the elbow end over the brass nozzle on the cube. The three remaining plastic pieces are ear tips—for small, medium, and large ears. Select the one that feels comfortable. Put it on the dangling end of the tube.

(4) Slide the cube onto your eyeglass or sunglass frame. You can put it on either the right or left side. Insert the black screw into the cube and tighten it.



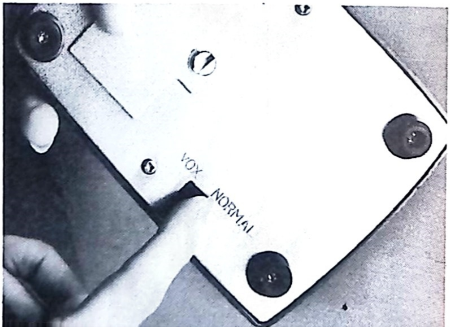


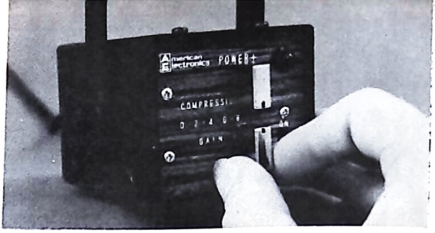


If it's the ultimate in convenience you're seeking in a mike, try combining a boom-mike headset with vox. What's vox? It's like saying, "Look Ma, no hands." VOX abbreviates *voice operated transmit.* No buttons to push, no levers to squeeze. Just talk, and transmit switching happens automatically.

One model of headset has vox switching built-in. A skin contact microphone rests on your cheek. You talk. The mike and its circuitry operate your transmitter. (If you think out loud, better stick with push-to-talk microphones.)

Vox usually comes as a separate accessory, or wired into the transmitter as part of the speech-amplifier section. Mikes for use with vox-controlled transmitters have to be wired a certain way. Your communications technician can wire it for you. Or, you can buy a mike, usually a desk model, that has the right circuitry already arranged. You just flip a switch to set the mike for vox operation. Such mikes are a top-of-the-line item, and likely include amplification. A push-to-talk button and lock lever let you elect to hand-key your communications whenever you prefer.



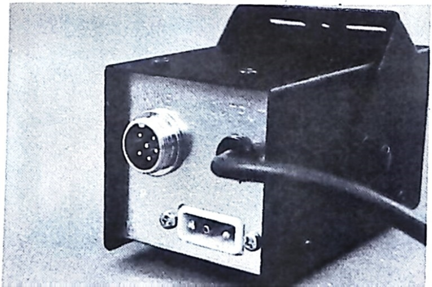


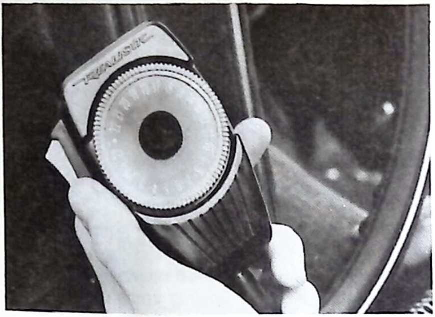
You have yet another special alternative in microphones. Sometimes this feature comes in a separate mike accessory.

Your chief interest in mikes should aim toward obtaining the most workable outgoing sound for your two-way communications system. To fulfill this ambition, you may work your way through a variety of mikes. But what if you get reports that you're overmodulating? Or that your voice swings back and forth between over- and under-modulation? Don't despair. You can find a happy medium. For that sort of difficulty there's a *modulation compressor* mike, or a *speech compressor* mike accessory. Some noise-canceling mikes include compression circuitry.

A speech compressor smoothes out the peaks and valleys in voice levels. The intent is to produce an even sound range. Actually, compression seems to lend your communicating voice strength and clarity. You might liken a speech compressor to an automatic pressure gauge. You set the level you need. Then, when the pressure gets too high, the gauge holds it down. A too-loud voice, or a shout, gets reduced. Feed in a too-soft voice, and the device boosts it. You end up with a more constant modulation level for transmitting.

If you're satisfied with the operating features of your microphone, you might want to invest in a speech compressor add-on. Watch out for the plugs on these. You don't want a compressor with a six-pin plug if you have a transmitter and mike that take four-pin connectors. You may need to have a short cable made up to adapt this device to your transceiver (proper plugs on each end). If you can't find a compression accessory with the connections you need, or can't make an adapter cable yourself, give the job to your radio technician.



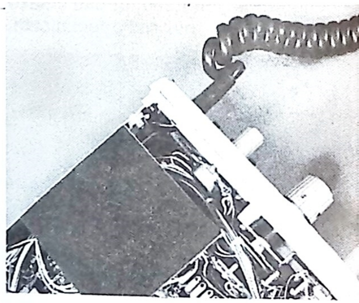


You might tackle a lot of replacement or accessory mikes, and expect complete success. But some mikes *you* should not try to replace.

If you're a CBer, a channel-selector type mike is an example. Certain of these mikes have at least two-dozen wires in the cable from mike to radio. Such mikes fit only their own transceiver models—which are without a channel selector on the radio. You only replace one of these mikes in a repair situation, anyway. Take it to a licensed radio technician. He knows how to cope with the complex rewiring of a replacement.

Then there's the transceiver with the mike cable wired into the radio—no connector. We've opened up one transceiver like that; to show you that replacing or converting this type of mike can be complicated.

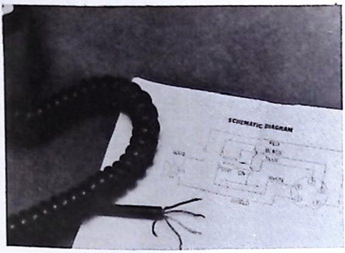
First of all, you have to reach the soldered cable connections inside. Then you must be expert with the soldering iron to free those old connections without damaging something else. Too much heat in the wrong place and you create more defects than you cure. You must be able to solder the new wires into the circuit without leaving solder blobs to short-circuit your transceiver. In other words, unless you're an experienced solder freak, take this kind of job to a qualified technician. His work is cheaper than a new transceiver.



When you buy a new microphone, it may not have a connector attached. Or, the connector it has may not fit your radio. One problem among two-way radio brands is the lack of standardization in mike plugs. Your radio may take a 2-pin, 3-pin, 4-pin, 5-pin, 6-pin, or phone-type plug. Know what kind before you go mike shopping. Look for male or female. You can't mate a 4-pin male mike plug to a 4-pin male receptacle. Look also at pin configuration. Just because a plug has the right number of pins does not mean it will fit.

Safest way is to buy an appropriate connector along with the new mike. With mike and connector in hand, you face the next challenge—getting the connector onto the mike cord. A 6-wire mike, such as an amplified model, sometimes works into a 4-pin plug. That's okay, if you know how to wire the cord into the connector.

If a mike doesn't have a compatibility list or a wiring booklet, don't buy it. You face an almost impossible task without this help. Miswiring could ruin your radio or the new mike. The next several pages contain a wealth of hints and guidance. But in no way can they substitute for your transceiver schematic and the wiring directions you should receive with your new mike.



The most popular mike cable consists of three wire conductors, each covered with insulation of some color, and one shield (a braided metallic covering for one or two of the wires). The conductor colors usually are red, black, and white, although you'll find yellow, violet, green, and blue as well. There's no standard color coding. But among replacement mikes we've used and examined, the following color code seems prevalent: White is the voice "hot" wire. The shield, usually terminating as a bare wire, is ground. The red conductor typically goes—via the connector, as the other wires do—to a relay connection inside the transmitter.

However, from there color codes begin to grow confusing. Variations depend on the type of t/r (transmit/receive) switching inside the transmitter. In your mike wiring guide, t/r switching style is indicated by E for electronic, R for relay, and S for special (a variant of electronic t/r switching). Black or blue often get involved in auxiliary switching. Yellow or green may hook up to the speakers.

When instructions show a switch with a 1 and 2 position, read *all* the instruction sheet. The mike possibly has electronic/relay option, which allows it to match more radios.

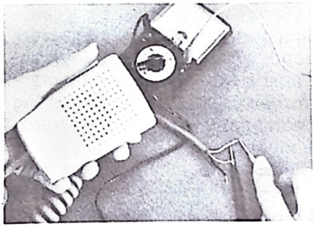
Sometimes wiring requirements demand that two wires fit into the same mike connector pin. You see how to treat this situation on pages 34 and 35.

You'll run across the terms *floating free* and *NC*. Both mean that no wire is connected to that particular pin in the mike plug. Many mikes come with the conductors already stripped and tinned for soldering. Where such a cable has a wire not connected, clip the bare end of that wire back so no bare wire extends beyond the insulation. If you leave the bare end loose and hanging, it can short-circuit something.

Use the old mike wiring as your guide to connecting the new one. Without this guide, you'll have to identify wires in the new mike cable. Get out your multimeter. Find your transceiver schematic too. Set the voltmeter to read *ohms.* Clip the negative (black) probe to the bare shield wire. Scrape the positive (red) probe against the bare tips of the conductors, one by one. You should not find a meter reading on the switching wires, unless the mike button is down. But the voice "hot" wire will usually bounce the needle toward zero on the ohms scale.

Knowing which wire (usually white) carries voice signals, note from the transceiver schematic what connector pin takes that wire to the *speech amplifier.* Note also which pin accepts the shield, or ground. With those two identified, others are easier. In three-wire systems, the only one left goes to whichever other pin the transceiver diagram shows occupied. In four-wire systems, you may find another grounded pin shown: connect black to that pin and red to the remaining one. (If you choose wrong here, the transmitter may squeal when you key it. Reverse the two.)

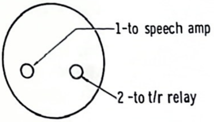
For electronically keyed transmitters, you have to identify which mike wire is for transmit, and which for receive. Clip the black meter probe to the shield wire. Ignore white. Touch the red meter probe to red and to black wires. One should bring the ohms needle to zero. That's the receiver wire. To verify, squeeze the mike button. The zero reading should disappear. Touch the red probe to the other wire. With the mike button down, *that* wire should show zero ohms, proving that it keys the transmitter on. Find the appropriate connector pins from the transceiver diagram, and proceed with plug wiring.



2-Pin Connector

Sample transceiver:
Browning Golden Eagle Mark III
(R-Relay Switching)

Transceiver Schematic



Mike Cable

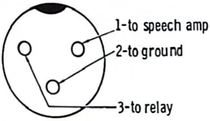
1-white-voice hot wire
2-black-keying wire

Solder red wire and shield to shell.

3-Pin Connector

Sample transceiver:
Teaberry 5 x 5
(R-Relay Switching)

Transceiver Schematic



Mike Cable

1-white-voice hot wire
2-red and shield-ground
3-black-keying wire

Mike connectors present other puzzles. When at all possible, use your old connector on the new mike, or at least as a guide for wiring. When the original connector has its pins numbered, those numbers usually correspond with mike wiring instructions. But check it against your transceiver schematic. Manufacturers frequently revise wiring in their transceivers. The wiring in the mike info may no longer match your later, revised transceiver. Verify before you solder connections.

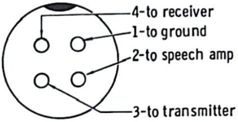
Replacement mikes with four wires are common. To hook up such a "universal" replacement to two- or three-wire plugs, note the wiring shown here. These might not work for your specific radio. But they should leave you with some idea how to deal with actual wiring situations.

Attaching a mike connector isn't the simplest thing you've ever done. But you can manage it, with patience, knowledge, and a fine-tipped soldering iron.

4-Pin Connector

Sample transceiver:
Cobra 21
(E-Electronic switching)

Transceiver Schematic



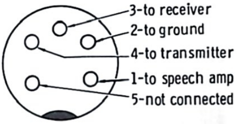
Mike Cable

1-shield-ground
2-white-voice hot wire
3-black-keying (xmtr)
4-red-keying (rcvr)

5-Pin Connector

Sample transceiver:
Midland 13-884
(E-Electronic switching)

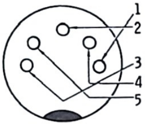
Transceiver Schematic



Mike Cable

1-white-voice hot wire
2-shield-ground
3-red-keying (rcvr)
4-black-keying (xmtr)

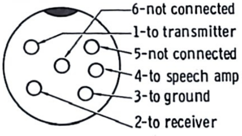
NOTE: Some manufacturers use a 5-pin DIN plug for their transceivers. Here is the 5-pin DIN configuration, but without any assignments.



6-Pin Connector

Sample transceiver:
American Electronics "Freedom"
(E-Electronic switching)

Transceiver Schematic



Mike Cable

1-black-keying (xmtr)
2-red-keying (rcvr)
3-shield-ground
4-white-voice hot wire

If you're clumsy, chronically nervous, or have large hands, don't try to wire a mike. If you're inexperienced at soldering, practice on some junk wire until you get the hang of it.

In wiring a mike connector, you need more than two hands. You need one to hold the solder, another to hold the iron, and a third to hold the connector. For that third hand, use a small clamp-on vise. Attach it to the edge of a table, cabinet top, or breadboard.

Here are some quick hints to steer you clear of trouble. (1) Keep the bared conductor ends short to help prevent short-circuits in the connector. (2) Use only rosin-core solder. It's for electrical wiring. (3) Don't leave the soldering iron on a wire or pin very long. It builds up excessive heat that melts insulation. Heat a connection barely long enough to flow the solder. (4) Apply solder sparingly. You'd be surprised at the strength of a little dab. Too much solder runs into places you don't want it. (5) Tin the ends of conductors to be soldered. To tin a wire, heat up the wire with the soldering iron and melt on a thin layer of solder. (6) Remember there isn't much room inside a mike connector. Work carefully.

Don't let anyone mislead you that it doesn't matter what wire goes where on unnumbered plugs. If the plug is notched, or the pins are asymmetrical, positioning definitely does matter.

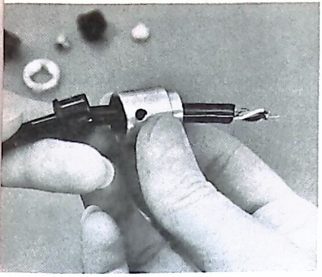
On to the how-to. If the wires weren't already stripped and tinned when you bought the mike, do it now. With a razor blade, slice gently through the outer insulation of each conductor, about 5/16 inch from the end of the cable. Slip the insulation off, exposing the wires.

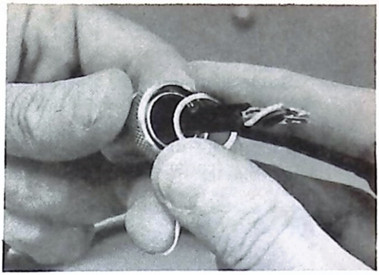
Disassemble the connector. Some have two sizes of cable clamps. Slide the snug one, larger end first, onto the cable. Slip the connector shell on next, and snap it to the collar or clamp. (If the cable was pre-cut at the factory, the conductors may be hard to thread through the connector parts. Twist them together first.) Slide the retaining ring on.

You're ready to make connections. Heat up your soldering iron. Measure the bared tips of the conductors. Snip off any bare wire over 1/8 inch. Twist loose strands, and tin them. Clamp the pin insulator into the vise.

With your wiring data at hand, line up the conductors with the right pins. Push the conductor tips into the holes in the connector terminals. Recheck that each color (and shield) connects where it should. Solder each wire to its terminal.

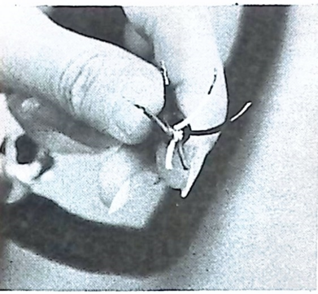
Anywhere your wiring instructions leave a conductor not connected or floating free, cut off the bare end of that wire. Since

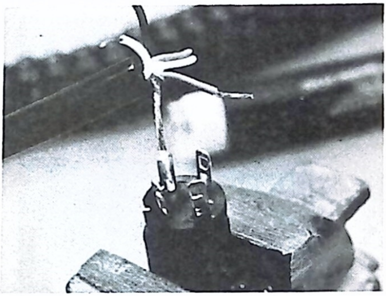


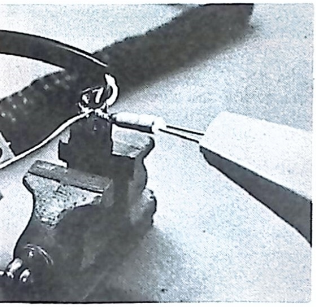


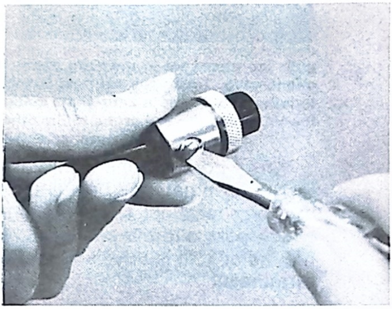
it isn't connected, it must be kept fully insulated. If two wires go to the same pin, twist the bare ends together first. Solder them to the pin as one.

After you've soldered the wires and they've cooled, tug on each joint to see that connections are solid. Resolder any that seem doubtful. Push the connector shell onto the pin insulator. Install and tighten all setscrews.



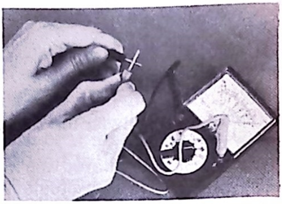




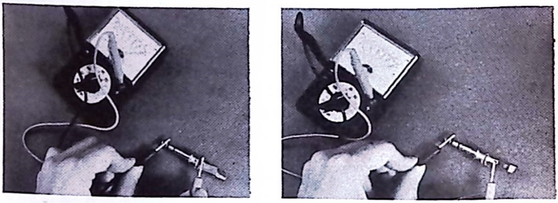


Some transceivers, particularly ham models, take a mike connector called the *three-circuit phone plug*. It comes in two styles —straight and right-angle. A straight model suits a mike jack on the front of the radio, or near the bottom. Jacks located on the side of a transceiver need the right-angle phone plug.

Mike wiring instructions use the terms tip, ring, and shell. Remove the plastic cover from the plug. This lets you see the terminals where the mike conductors attach. The shortest terminal connects to the plug tip; the intermediate terminal to the ring; and the large curved terminal to the shell of the plug barrel.



You needn't take anything for granted. Verify connections with your multimeter. The low-cost meter shown here runs on its own battery. Switch the function dial to measure *ohms* (1KΩ). Touch the test probes together. The meter pointer shoud jump over to the zero-ohms side. If it doesn't replace the battery.

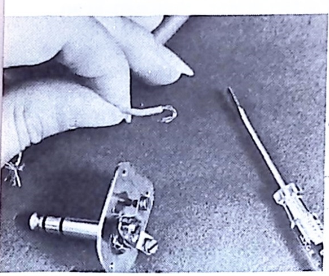


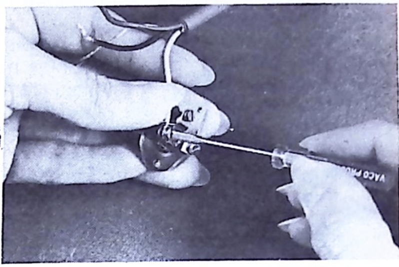
With the meter set to measure ohms, touch the black probe to the tip of the phone plug. Touch the shortest terminal with the red probe. If these two go together, you'll see a zero-ohms meter reading. With the black probe still on the tip, touch the red probe to the other two terminals. The pointer should not move at all. If it does, something's wrong. Don't use the plug.

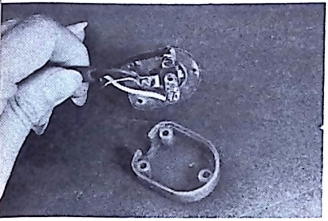
Verify connections between the plug ring and the medium-length terminal, and between the shell or barrel of the plug and the long terminal shank. Having noted which terminals are for which part, slip the plastic cover onto the mike cable. With wiring details to study, solder the mike conductors to the plug terminals.

A few right-angle phone plugs have numbered terminals. This is fine and dandy, except that you still don't know for sure how to wire the plug until you use your ohmmeter as the opposite page describes.

Rather than solder terminals, this phone plug has screw terminals. They're easier than the soldered kind, but connections aren't as sturdy. In constant use, screw terminals may work loose. If you notice intermittent output, or no response to your transmissions, suspect this mike plug.

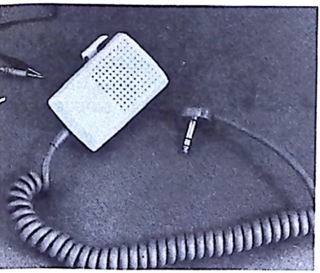






Use a tiny screwdriver. Remove the plastic housing. Set it aside; you'll work inside the metal base.

You'll find three terminals. With wiring notes handy so you know what wires go where, shape a loop in the tinned bare end of your first conductor. Slide it onto the appropriate terminal, and tighten the screw. Attach the second conductor the same way. That leaves two mike-cable wires, but only one screw. Twist the bare ends of the two wires together and attach them to the ground terminal. Suggestion: Drop a bit of solder on each wire to hold it to its terminal. It could save you hassle later.



Situate the conductors carefully in the plug lid. Make sure that only insulated portions of the cable extend outside the plug housing. Make certain no bare wires can get near each other inside. Screw the lid back onto the plug base.

If you attempt any mike repairs at all, most likely it will be to replace the mike cable. Mike cables come in many versions—both in length and in number of conductors. Be sure you know the number of conductors needed for your mike before you track down a replacement. You may need to remove the back from the mike to find out. Count the wires in the cable.

How will you know the mike cable is bad? Sometimes you can see it—like fraying at the mike or at the plug. Other times you'll see it on an output meter; transmitter keys intermittently, or modulation cuts in and out. Maybe you hear about it: another operator says your transmitting is intermittent. You can even *feel* some cord damage.

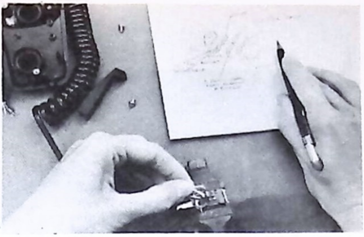
You need a replacement cable, soldering iron, solder, wire cutter/stripper, small vise, plus pencil and paper. Unplug your old mike. Put it and the replacement cable side-by-side. Carefully disassemble the mike plug so you can see how the old wires connect. With pencil and paper, note pin numbering—if there is any—and what color of conductor goes to each pin. Where you find a difference between colors in the old cable and the new, assign new colors to the pins; write down your new color code.

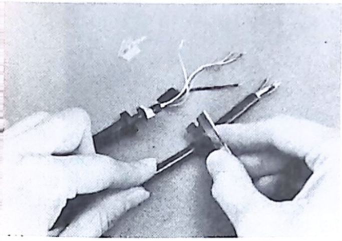
Select one end of the new cable to go to the mike. Prepare the other end for the plug. Take apart the old plug and place its pin insulator in the small vise. Disconnect the wires. Touch a hot soldering tip to each connection, and pull the wires free as quickly as you can. Don't overheat the pins. Slide the connector shell and parts onto the new cable. Solder the wires, and reassemble the connector.

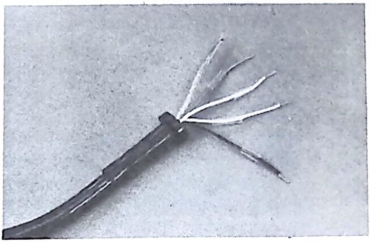
That leaves the mike end to connect. Remove the screws that hold the microphone halves together. If you have a handset, unscrew the mouthpiece to expose the wires. Make a drawing of which wires go where, with wire colors labeled. Unscrew the terminal block for better access, if you can. Trying to solder inside the mike housing is touchy. Clamp the terminal block in the small vise as you did the mike connector.

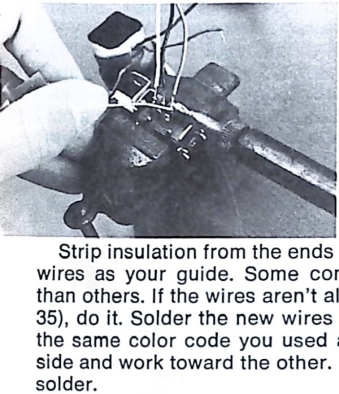
Disconnect the old cable from the mike. Heat up the soldering iron before touching it to each terminal. Free the old wires quickly, and get the iron off the terminals *fast.* Overheating could damage the mike element.

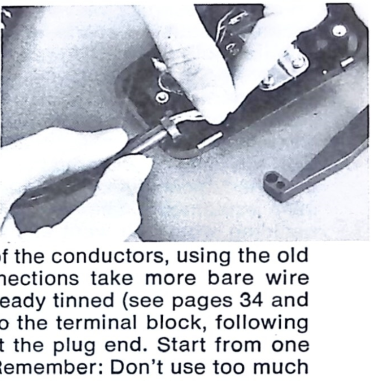
Pick up the raw end of the new cable. Strip the outer covering back about 3 inches from the end. The original cable may have had clear plastic sleeves over the terminals. Use these sleeves with the new cable. They insulate each connection from the others. Transfer grommets, strain clamps, etc., onto the new cable.





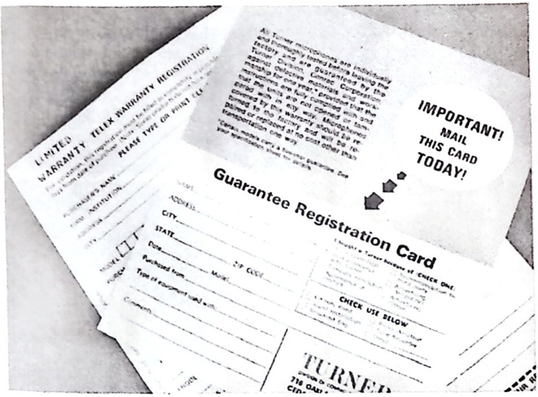






Strip insulation from the ends of the conductors, using the old wires as your guide. Some connections take more bare wire than others. If the wires aren't already tinned (see pages 34 and 35), do it. Solder the new wires to the terminal block, following the same color code you used at the plug end. Start from one side and work toward the other. Remember: Don't use too much solder.

When all connections are firm, verify that you've wired correctly. It doesn't hurt to make sure one more time. Slip the clear sleeves down over the terminals. Screw the terminal block back into the mike. Arrange conductors and cable sleeves so they fit inside the mike with no pinching. Make sure a cable sleeve protects the cord where it enters the mike. Screw the mike back together.



LIMITED WARRANTY TELEX WARRANTY REGISTRATION

PLEASE TYPE OR PRINT

PURCHASER'S NAME

All Turner microphones are individually and thoroughly tested before leaving the factory and are guaranteed by the Turner Division, Conrac Corporation against defective materials and workmanship for one year,* provided that the instructions are fully complied with and that the units are not opened or tampered with in any way. Microphones covered by this warranty should be returned to the factory and will be repaired or replaced at no cost other than transportation one way.

IMPORTANT!
MAIL
THIS CARD
TODAY!

Guarantee Registration Card

NAME
ADDRESS
CITY
STATE
ZIP CODE
Date
Purchased from
Model
Type of equipment used with
Comments

CHECK ONE
CHECK USE BELOW

TURNER
716 OAK

For the most part, we've kept you out of mike innards, except to change batteries and cables. Better mikes carry a warranty—some up to one year. However, if a new mike fails because of your wiring or tampering inside the mike, you void the warranty. Keep your mike tinkering at the connector or battery chamber.

With what you've seen in this chapter, you can handle almost any mike or mike accessory addition to your two-way radio system. Anything not covered here takes the advice and services of a trained technician. Now, when new or improved mikes and mike equipment come along, you shouldn't have any problems deciding what you want and figuring out how to wire it into your station setup.

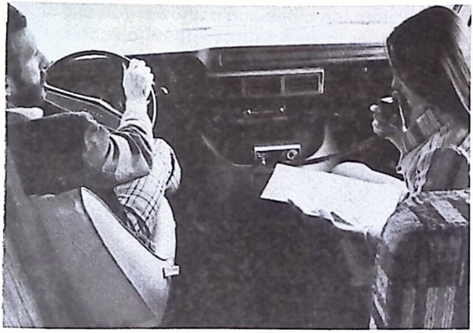
CHAPTER 3

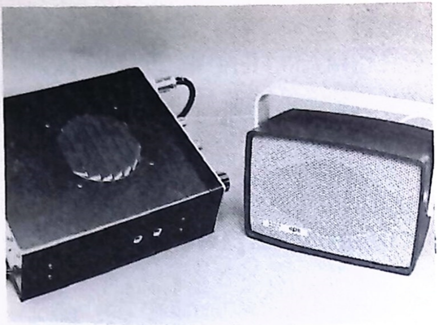
Easy Listening With Auxiliary Speakers

Why would anybody want extra speakers when they already have one in their transceiver? Maybe at first thought auxiliary speakers are just an added, useless expense. Think again. External speakers *are* an added convenience. As often as not, they're a necessity.

Take for example a couple who travel in a posh recreational vehicle. They couldn't be without a CB radio. There's just one flaw. The speaker in their CB transceiver faces downward, against the motor cover. Not only is there the noise of the RV to contend with, but speaker output is blocked by the high-impact plastic of the vehicle's motor hood. Neither driver nor passengers can hear this radio clearly. It would be much worse if the motor hood were carpeted, as many are.

An auxiliary speaker mounted in the clear would greatly improve their two-way radio listening. An extra speaker back in the living section of this minimotorhome would improve the communications situation even further.

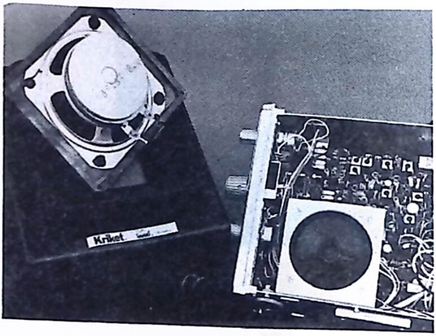


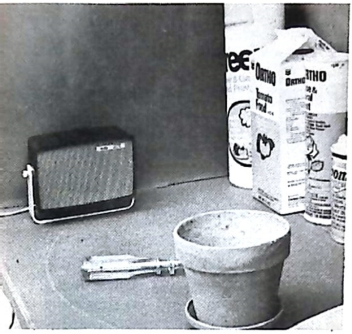


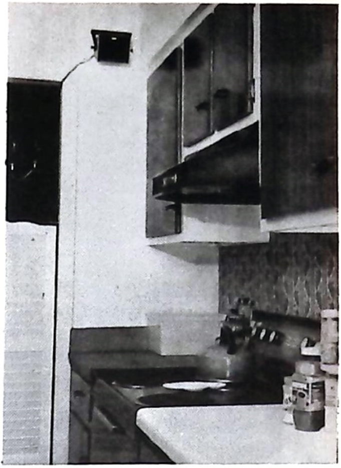
The standard transceiver speaker is necessarily small, and therefore limited in efficiency of output. Compare the size of the speaker in your average CB radio to that in a typical auxiliary speaker. The auxiliary speaker is twice as large—at least. That extra size turns out more sound. You don't strain to hear what's being said. You don't miss important messages. Big speakers permit stronger and clearer voice reception. That makes two-way radio more enjoyable and less strenuous.

Think back to the last violent rainstorm you drove in. Remember how difficult it was to hear your two-way radio? Yet you needed it then more than at any other time. Rain was pounding so hard on the vehicle roof that you couldn't hear easily. You had to devote your main attention just to driving. Consequently, you had to let crucial road reports slide by.

You needed a well-placed auxiliary speaker. Later, in Chapter 7, you'll see one of the handiest speakers around. It's a hump-mounted speaker cabinet on which you mount your transceiver. Not only does it make listening close and easy, but you can store speaker and radio together in your trunk (without disconnecting anything but the cables). It helps prevent CB ripoff.



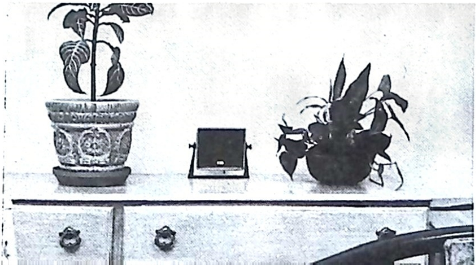


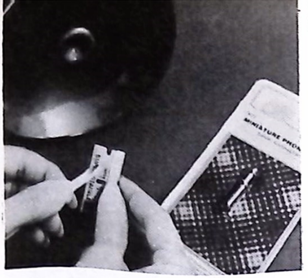


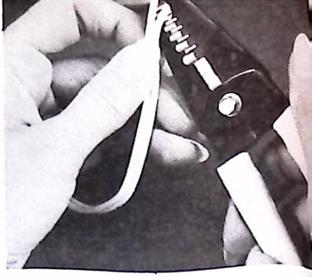
Perhaps you're beginning to suspect the value in external speakers. They come in handy in plenty of other places too. For example, let's say you have a workshop in your garage, and a Citizens Band or ham station in the house. With an auxiliary speaker, you can monitor the favorite local channel while you putter around in the garage. Then if your Good Buddy down the street (or your ragchew pal halfway across the world) gives you a shout, just chase your body into the house and answer the call.

Or maybe two-way radio is a family affair at your house. Put an extra speaker in the family room (where everyone spends most of their time anyway). Then you can ratchet-jaw in the den while everyone else watches television. But should the others want to listen in on the neighborhood hotline, they've got that extra speaker to switch on.

You might want an extra speaker in the kitchen or the laundry room. Do you use two-way radio for conducting your own small business? If you have a spouse at home who needs to hear your calls, speakers all around the house get the message through.







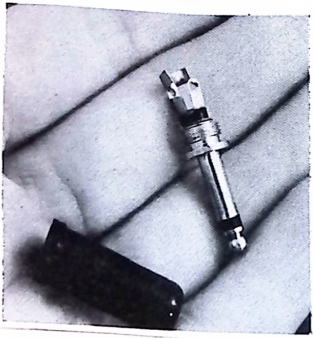
Connecting all those extra speakers to one transceiver isn't entirely simple. As usual, you suffer the aggravations that come when there's no standardization. First of all, speaker plugs don't always fit. To use a speaker you've chosen, you may have to cut off the old plug and solder on a new one that fits. Some speakers you buy have no plug at all. *You* must complete the wiring.

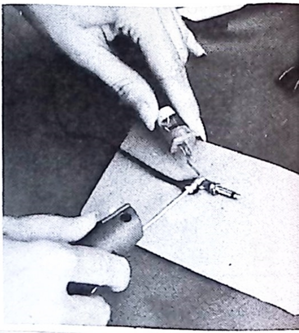
The speaker plug is very like the mike phone plugs you saw attached on pages 36 and 37, only tinier. And with a speaker, you have a two-circuit plug and only two wires: one hot and one ground. Some speaker wires are coded, the ground being plain and the hot wire striped or ribbed. However, many are not coded at all. That's because unless the speaker has special grounding, polarity of connection doesn't matter.

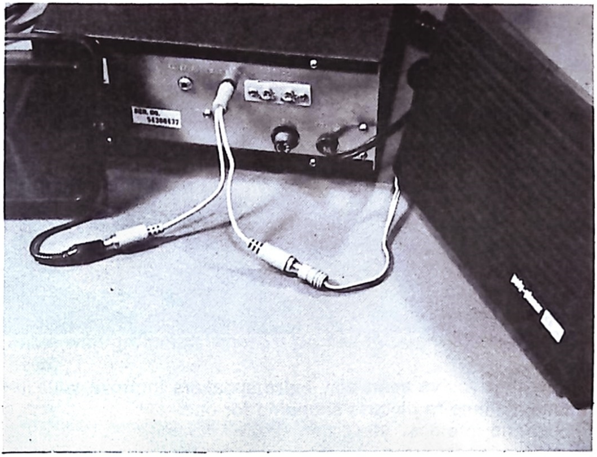
Here's how to go about attaching the new speaker plug. Cut off the old plug. Unscrew the plastic cover of the plug, and slide it onto the wire. Slice between the wires with a razor blade, and separate them for about 3 inches. With your wire stripper, remove about 3/8 inch of insulation from the tip of each wire. Tin the bare wires with solder, to hold the strands together and make later soldering easier.

If the wire is coded, attach the hot wire to the short terminal inside the plug. Make a loop in the bare wire end. Thread this loop through the terminal and solder. Don't use much solder.

Connect the remaining wire to the shell terminals. Let the solder cool. Move the wires to see that they hold to the terminals. Replace the cover.







Your transceiver may have one external speaker jack, or it may have two—one for an auxiliary speaker, another for a PA (public address) speaker. Plugging in an auxiliary speaker, with most transceivers, cuts out the speaker in the radio. Therefore, at a base, if you plan to add an external remote speaker, plan for two. One goes at the base, the other at your remote location.

That leads to another problem. Two speakers . . . one jack. Remedy that with a Y-adapter plug. This adapter gives you two sockets into which you plug the two external speakers. The adapter goes in the auxiliary speaker jack.

Before you hook up those extra speakers, it's a good idea to see how much speaker wire you need. If the wire isn't long enough, buy regular hi-fi speaker pairs, in whatever length you may have to add. Long speaker wires should cause no problems with your communications reception. Just see that your splices are solid and well wrapped with tape, and the plug properly soldered.

Tuck speaker wires out of the way so they won't get ripped loose, or cause falls or other accidents. You might even tack them away safely with an *Arrow* T-18 tacker. These staples are small, and yet big enough to secure speaker wire. Be cautious that you don't staple into the wire. Place your tacker so the staple bit straddles the wire, then press.

Now that you've seen how extra speakers improve your listening, it's time to discuss shopping for one.

First and foremost, you'll get the best communications sound if you buy speakers designed especially for voice-only reproduction. Stereo or music speakers have too wide a frequency response. That wider range unmasks a lot of unwanted noise for two-way radio. Today's communication transmitters only modulate with voice frequencies between 300 and 3000 *cycles per second* (now called *hertz* and abbreviated *Hz*). A speaker responsive to more than that range would be pointless.

Don't be bamboozled into buying a "sale" speaker. Listen to the speaker. Don't play music through a speaker for two-way radio. Listen to it connected to a two-way radio. Usually, your communications dealer will let you take it to your car for a listen. Or he may have a CB radio hooked up so you can try speakers. Check out at least two speakers so you can compare voice reproduction. Don't buy one unless it sounds crisp and clear to you.

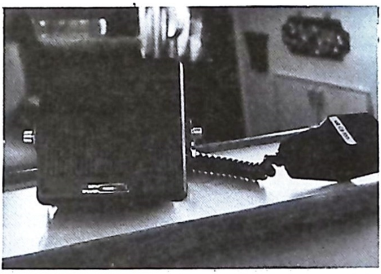
Where you plan to put a speaker determines what style to look for. Indoor speakers can look either serviceable or decorative. Ask yourself some questions. Is the bracket sturdy and easy to mount? Does the speaker come with ample wire? Does it have a warranty?

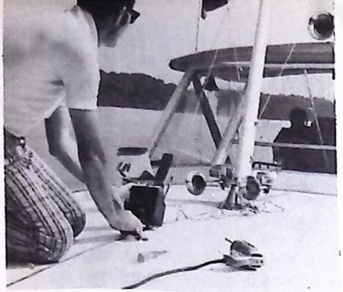
For outdoor speakers, add these queries: What are the limits of hot and cold the speaker can take? Some can't stand extremes of either. Is the speaker waterproof? Batter-proof? Will it fit where you plan to put it?

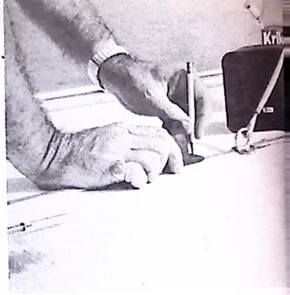
In noisy locations—trucks, boats, recreational vehicles, factories, yards, and the like—amplified speakers put even more sound across. Be careful if you place an *amplified* speaker farther than the original cable allows. Impedance may be affected by adding cable. This concern applies to other specialized speakers as well.

At least one manufacturer offers a remote speaker that has facility for a mike to be attached. You can both monitor and talk from this speaker. And should necessity arise—like a fire in the boat galley, for instance—you can radio for help right from the remote speaker. Auxiliary speakers with mikes could be life savers in strategic locations on boats or in recreational vehicles.

Find the shortest possible route from the transceiver to this secondary speaker/mike location. Keep within 15 feet of the transceiver. If you must, drill a hole for the cable; but protect the cable with grommets where it passes through the wall or bulkhead.







Most especially on boats, it's handy to have a PA speaker on board. Use it as a hailer, or switch the two-way radio through it. You can then listen to weather reports or other marine radio information (or CB) without sitting at the radio all the time. Many transceivers have the facility built right in.

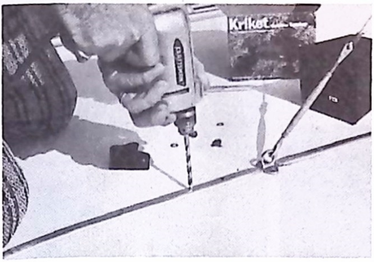
It doesn't take long to wire up a PA speaker on your boat, nor does it take a lot of tools. You'll need a drill, a Phillips screwdriver, a regular screwdriver, a centerpunch, hammer, and some caulking.

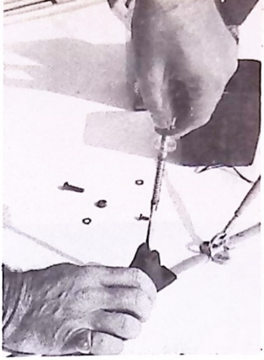
First decide where you want to put the speaker. Situate it so that if you use the system as a hailer, you can aim the speaker from the wheel (where your radio hangs). It should also be out of the way so that no one inadvertently trips over it and consequently over the side of the boat. Also, keep it near enough that you can run the speaker wire conveniently back to the radio.

In order to simplify the cable run, one boater conceals the speaker wire under the molding that runs up the center of the forward deck. Look for at least one screw already in the molding, to use as one speaker-bracket screw. You want to drill as few holes as possible. Position the speaker and bracket to verify that they fit. Next, remove the speaker from the bracket and mark where the other holes must be drilled. Use a hammer and centerpunch to indent the aluminum molding strip. Do not loosen the screws in the molding until after you have drilled the additional holes. Use a drill bit that suits a number 8 screw.

Remove the existing screw. You will need a longer one, about a half-inch longer, but with thread size the same as the original. Put some caulking under the bracket. Install and tighten the screws. Once the bracket is secure, attach the speaker.

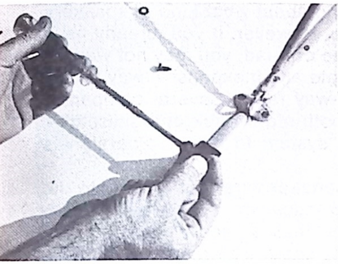
The molding strip on some boats breaks at the mast. Begin your cable run under the second section of molding. Remove the screws holding that piece of molding. Put the screws in a box or dish to prevent their getting lost.

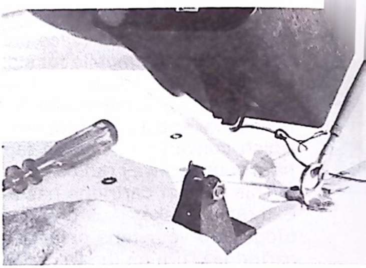


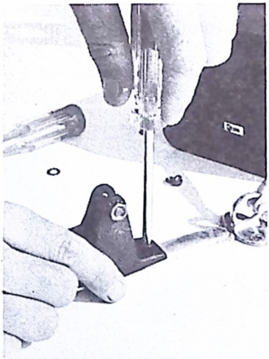


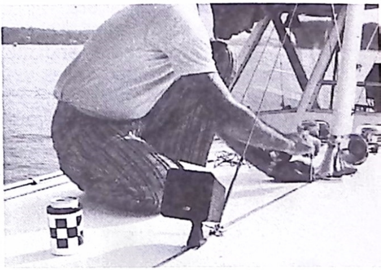
Run the speaker wire along the seam which the molding covers. If you feel you must drill a hole to reach the transceiver, drill it larger than the wire and fit a rubber grommet in it. The grommet helps seal the hole, and protects the wire from sharp edges of the wood.

Run the wire all the way to the transceiver. Plug it into the radio. Test the speaker on "PA" to see that it works. Once everything is okay, spread the molding generously with caulking.









We've done a good bit of talking about what kind of speakers to have and where to place them. However, if you already have speakers in your mobile for stereo or quad, you may not want to add even more. There's one simple and inexpensive way to use those existing speakers for two-way radio. Several companies now make special cartridges—both eight-track and cassette—which convert your stereo tape system to carry voice signals from your two-way radio.

This special cartridge has a speaker wire that plugs into the External Speaker jack on your transceiver. You shove the cartridge into your tape or cassette deck as you would any tape cartridge. Turn on the transceiver and the stereo, and you have instant auxiliary speakers.

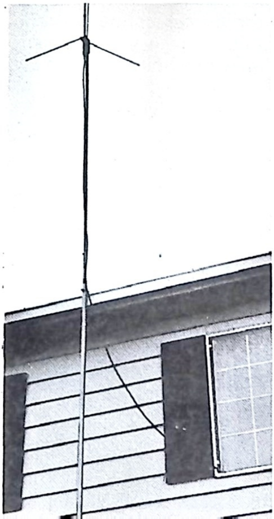
I know we said earlier that speakers meant for voice-only are best for two-way radio, and they are. But using speakers you already have installed saves you a lot of time and money. You sacrifice a bit on clarity and crispness in voice reproduction. But the economy might be worth it.

CHAPTER 4

Cable and Connector Know-How

Antenna cable forms a pathway from transceiver to antenna. It should be an uninterrupted line for unimpeded transmission and reception. But, a lot of things can happen to antenna cable. Whether on a mobile unit or at a base, cable can get weathered, mashed, crimped, ripped, rubbed, and whipped. You should understand how to take care of antenna cable, not only when you hook it up, but afterward too. You don't want to lose the efficiency of your two-way radio outfit when you need it most.

Take this chapter as a catechism of coaxial cable know-how. You see cable construction, how to apply all the popular connector types, and how to use some associated accessories. In all, you have here a reference to guide you in almost any cable situation.



TANDY WIRE AND CABLE TYPE RG 59/U FOAM
TANDY WIRE & CABLE CO RG 58/U TYPE
WIRE AND CABLE CO TYPE RG-8/U

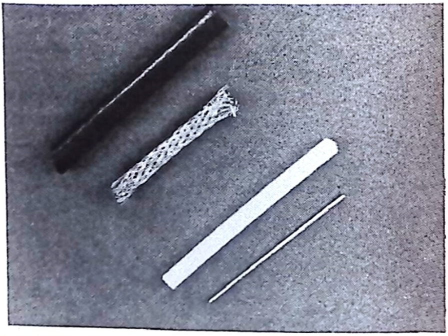
Two-way radio cable comes in three types that are in common use. Their designations are RG-8/U, RG-58/U, and RG-59/U. You'll find RG-8/U used mostly with a base antenna. It's the most expensive of the three, and its half-inch size wastes less power than the other two. For cable runs of more than 50 feet, you need RG-8/U to keep signal losses to a minimum.

RG-58/U is the most common. Its quarter-inch size better suits mobile installations. Its losses are low enough for short base-station runs, when the antenna is near the transceiver.

RG-59/U is for dual antennas. Co-phased antennas, as duals are called, require meticulous matching. The RG-59/U cable, therefore, is usually measured and cut to match impedances precisely.

All three cables are *coaxial* in structure, made up of four distinct layers. What you see first is the outer weatherproof covering, made of vinyl. Under that insulation is a layer of wire braid. The braid encircles the cable just like the outer insulation. This braid, often called a *shield,* forms one of the two conductors in the cable. Under the braid comes thick white or clear plastic insulation, which surrounds the center conductor. The term *coaxial* comes from the fact that all the layers are concentric, sharing one axis. It takes a wire this complicated to provide you with a quality radio signal.

When black antenna cable looks unsightly, use white. It's popular for installations on light stone, brick, or frame buildings. It also looks better in light colored boat or RV interiors.

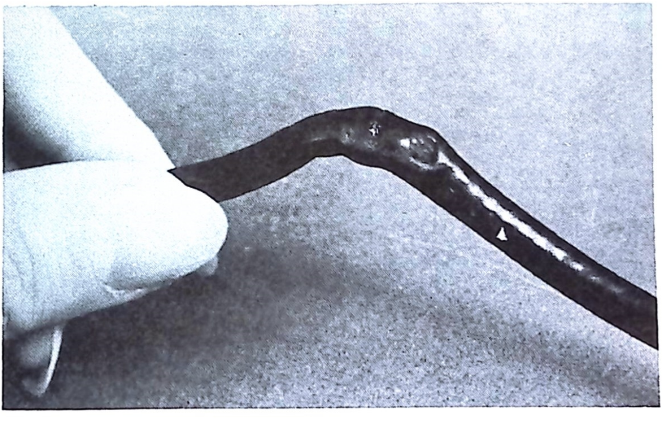


Coaxial antenna cable appears quite tough. But it can be damaged; and when that occurs, it has to be replaced. Cable is at the mercy of the elements and you. Car doors and house windows are shut on it repeatedly. Cables get rubbed raw on roofing shingles and against brick walls. Some get caught on sharp edges of antenna masts or towers during installation, and are damaged from the start.

One way to protect your cable is to see that it is installed along the most favorable paths to the transceiver. Protect it with carpeting or moldings in your home or vehicle. Secure the cable with plastic ties where you can find something solid around which to fasten them. Don't use a tree for an antenna mount or cable support. It can blow down in a strong wind, and branches break off. You have cable damage.

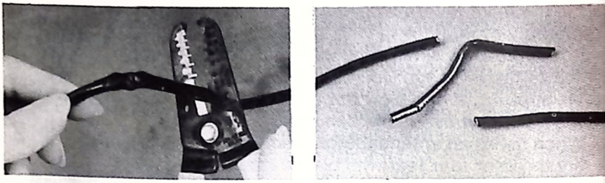
When using an antenna tower, secure the cable to a tower leg every three or four feet with plastic tape. Protect the cable with rubber grommets where you run it through holes in walls or auto bodies. If you fail to, don't be surprised to find your coax cut. Don't hammer the cable. Staple it only with a T-18 type of stapler, and carefully. If a staple pierces both conductors, you have a short.

All in all, however, coax cables hold up well. And whereas a few years back you would have replaced the entire cable if anything went wrong, today there are a variety of ways to inexpensively repair damaged cables and keep them working.

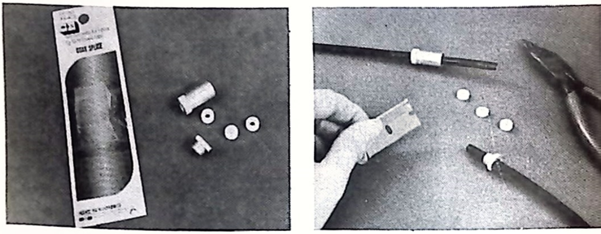


When you have a quarter-inch RG-58/U antenna cable crimped badly, as you saw on page 53, you can save it without buying and attaching a whole new antenna cable. But first, before you tackle the repair, find out why it got damaged; reroute the cable to prevent a recurrence.

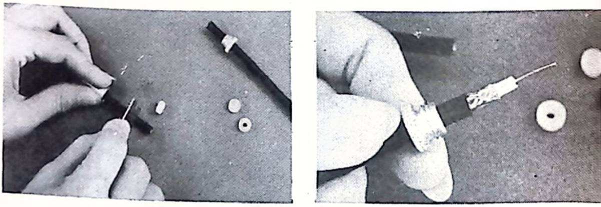
To repair this cable, you'll need wire cutters, a razor blade, and a coax splicer—a small component sold at many radio stores.



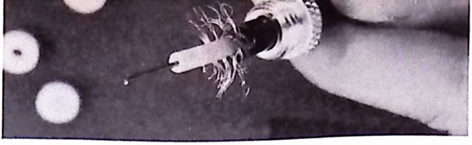
(1) Cut out the damaged section, about 2 inches on either side.



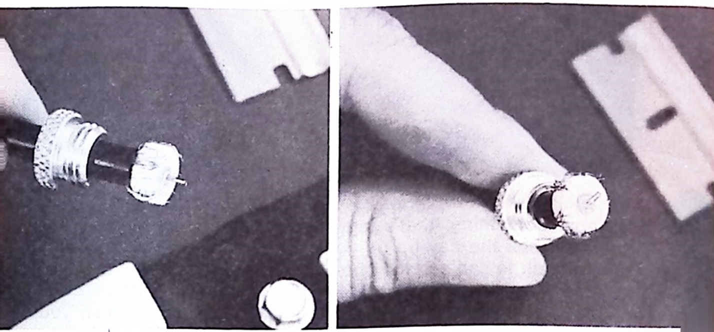
(2) Remove the coax (short for coaxial) splicer assembly from its package. Slide the two metal collars onto the two clean cable ends.



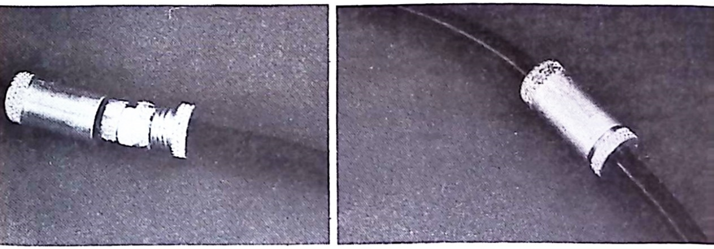
(3) About an inch from the end, cut through only the outer insulation on both pieces of cable. Do not nick the braid. Peel the insulation off. Then snip off ¾ inch of the shield, leaving ¼ inch. Finally, strip off ½ inch of inner insulation.



(4) Fan the braid back to the outer insulation. Trim the white inner insulation to fit the thickness of one of the hollow plastic discs. With the grooved side facing out, force the disc onto the center insulation. All braid strands must be on the outside.



(5) Push the braid up around the disc. With your diagonal cutters, clip off any strands of braid that protrude beyond the side of the disc. Don't cut them too short. They must not lap over and touch the center conductor, but they must make contact with the splicer shell. Clip the center conductor, leaving it just long enough to fold over inside the groove in the disc. It MUST NOT touch the braid.



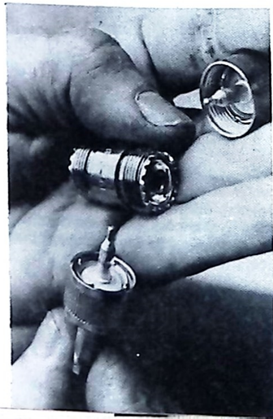
(6) Complete the same steps with the end of the other cable. You have a tiny disc remaining, one with a metal center. It goes between the two coax ends, inside the splice collar, thus completing the center-conductor circuit. The collar completes the shield circuit. Screw one coax disc assembly into the collar. Drop in the center disc. Finally, screw the other assembly into the other end of the collar. Use pliers to tighten both ends.

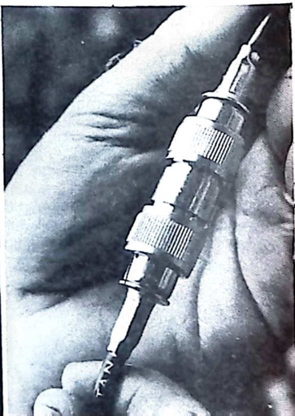
Know something that's aggravating and frustrating? Try spending half the day up on your roof getting the antenna up, just to find the cable is too short to reach the transceiver.

Time was, you'd have to start over from scratch. You can't splice a coaxial cable; it messes up the impedance. Yet, you can join two lengths of cable. You do it with a PL-258 connector.

The PL-258 is female on both ends. It mates to standard male PL-259 cable connectors. Therefore you can lengthen your cable by putting the PL-258 connector in-line between two separate pieces of coax, assuming each terminates in a properly installed PL-259 connector. You can buy lengths of cable that have PL-259's already attached.

After you have the PL-258 installed, wrap it thoroughly with plastic tape to keep the moisture out.

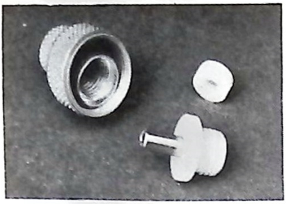




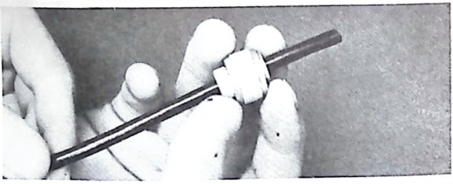
The vital link between cable and transceiver is the cable connector. You'll find a variety of connector types on the market nowadays—solderless, crimped, pliers-applied, and the standard soldered type. In the next several pages, you'll see how to install each kind.

Take solderless connectors as your first example. If your two-way radio is on a boat or RV, you probably store the radio out of sight when you're away from the vehicle. Storing or stashing sometimes leads to cable/connector damage, since you have to connect and disconnect so often. You may be out on a lake or in the backwoods before you get around to hooking up your radio. You pick up the antenna cable from the floor and find the connector smashed, or the cable ripped half out of it. Either way, you must repair or replace the connector.

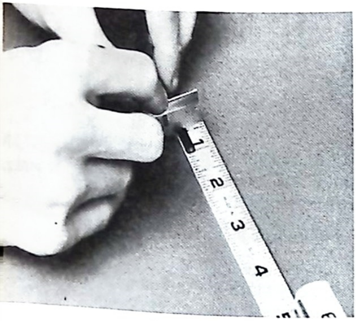
As you've already discovered, every wise radio operator keeps a few spare parts around—including connectors. You probably have a full tool box. But what if you don't have a soldering iron, or electricity to plug it into? You don't need these tools with a solderless connector. A single-edge razor blade or pocket knife suffices.



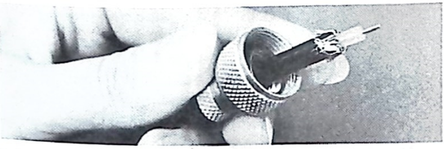
First, cut off the old connector and a couple inches of cable. Disassemble the solderless connector. It consists of a pin insulator, a Teflon spacer, and connector body with coupling ring.



Slide the connector body onto the cable. The inner threads should face the end of the cable. Push the connector body up the cable several inches and out of your way.

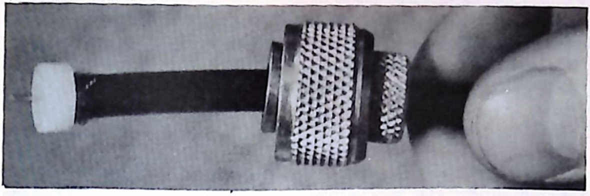


With razor blade or pocket knife, slice off 5/16 inch of outer insulation. Do not nick or cut through the braided shield. If you do, cut the cable end off and begin again.

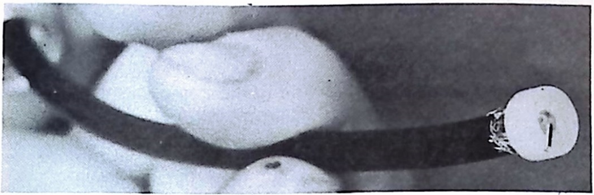


About ⅛ inch from the end, cut through the metallic braid and the inner insulation. DO NOT nick or cut the thin center conductor. Fan out the ⅛ inch of braid that's left, spreading it backward over the outer insulation.

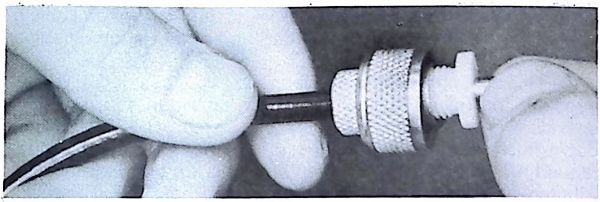
(NOTE: You might want to refer back to page 54 for a detailed explanation of cutting and preparing coax.)



Slip the little white Teflon spacer (a disc with hollow center) onto the inner insulation. Turn the sunken side toward the cable end. Push the disc snugly against the braid. Don't allow any strands from the braided shield to reach around the spacer.



Bend the center conductor so it fits into the sunken groove in the spacer. The wire must not stick out past the edge of the disc. If necessary, snip the wire shorter or curl it into the groove.



Slide the connector body up the cable. The Teflon spacer fits into the body. Screw the pin insulator tightly into the connector body. Use pliers to tighten it.

That completes the installation of a solderless connector. However, make sure you buy a truly solderless connector. Some companies put out a "solderless" connector that calls for at least one solder joint. A good solderless connector, as shown here, makes a handy temporary connector. For permanence, read on.

Soldered connectors are the most reliable of the several types. All joints are held firmly together by a solder weld. Naturally, this takes a little more time to install than the solderless type. But added effort proves definitely worth it to you in durability.

In the how-to sequence on the facing page, you see RG-8/U cable in the foreground and RG-58/U in the background. RG-8/U has a stranded inner conductor; RG-58/U has a solid center conductor. The procedure for installing a soldered PL-259 connector on each size is nearly identical. So some of the photos show both cables.

Assemble your tools and equipment—connector, cable, razor blade or pocket knife, measuring tape, soldering gun, solder, and diagonal cutters. For the RG-58/U, which is only 1/4 inch in diameter, you'll also need a UG-175/U adapter.

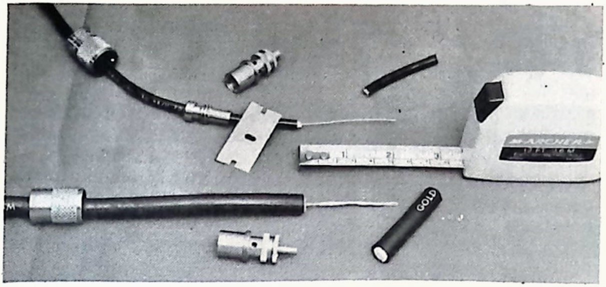
(1) Slide the threaded coupling ring of the connector onto the cable.

(2) Some 2 inches from the end of the cable, cut through the outer insulation (vinyl sheath), the braided metallic shield, and the inner insulation. DO NOT cut, or even nick, the inner conductor. It weakens the joint at the connector. If you injure the center wire, cut the end of the cable off and start all over.

If you're working with RG-58/U cable, now is the time to add a UG-175/U adapter. Slide it back up the cable toward the coupling ring, out of your way.

(3) With your knife or razor blade, slice through and remove about 1/2 inch of the outer sheath, exposing the braided shield. Use care in cutting, here. Don't scar the braid or chop off any of its strands.

(4) This next step differs between the two types of cable. Let's consider the RG-58/U first. Loosen the braided shield. Fan its strands evenly away from the cable. Slide the UG-175/U adapter down flush with the end of the vinyl outer sheath. Dress the fanned braid back over the adapter. Keep the braid strands distributed as evenly around the adapter as possible. Then, with wire cutters, snip the ends of all the strands of braid just above the thread rings on the adapter. No strand should extend far enough to interfere with the threads.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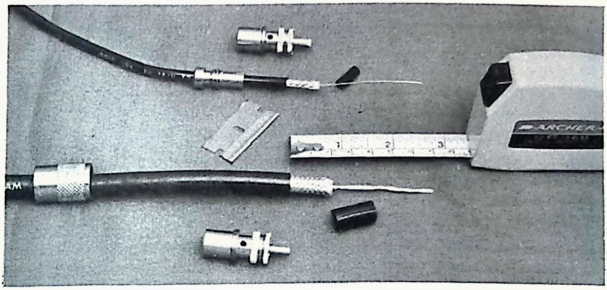
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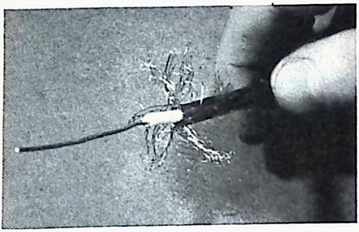
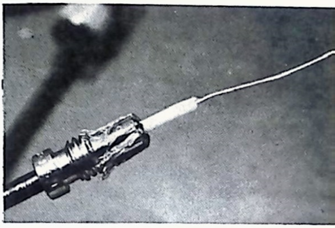
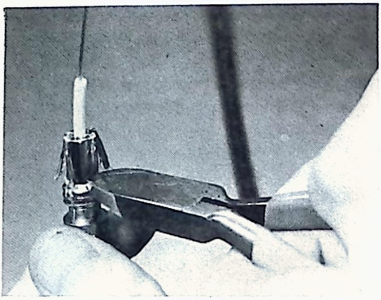






(5) Working with RG-8/U, you don't fan the shield braid out. Instead, you cut off about 3/16 inch of the shield. That leaves 3/16 inch of white inner insulation showing. Quickly, so as not to melt or distort the inner insulation, melt and flow some solder onto the shield strands. This makes a later step easier.

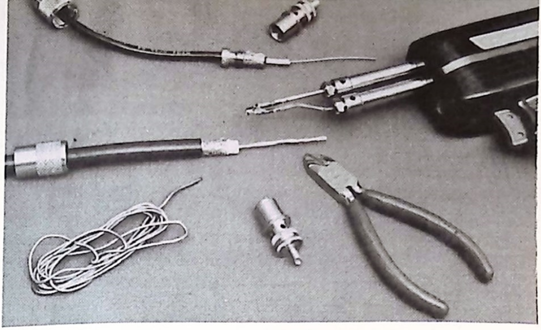
(6) Slide the connector body or barrel onto the cable, with the center conductor pushed through the connector pin. Notice the holes around the barrel of the connector in the smaller-diameter offset. You should see the braided shield inside, through those holes.

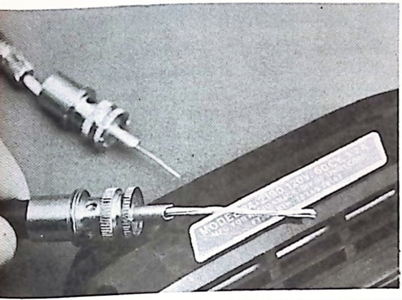
(7) After sliding the connector body onto RG-58/U cable, screw the adapter into the connector body. Of course the cable center conductor goes through the pin of the connector. With either kind of cable, you'll have a lot of center conductor sticking through the pin.

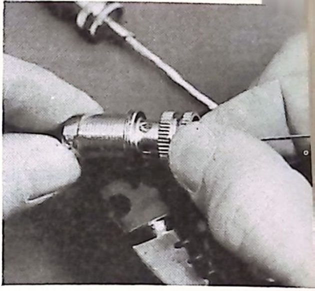
(8) Pick up solder and soldering iron. With the iron, heat the connector pin. When the pin is hot—a matter of seconds—touch the solder to the conductor so a bit of solder melts and flows inside the pin. Don't let a blob gather on the outside; the pin won't fit your transceiver socket. You need barely enough solder to hold the wire in the pin securely. When solder and connector have cooled, snip the conductor off even with the pin.

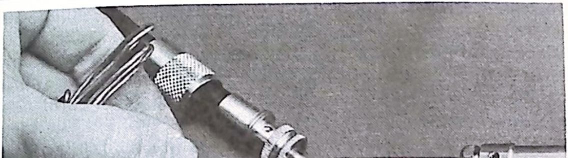
(9) This final step is perhaps more important with RG-8/U cable, where you need some extra holding power. Heat up the barrel of the connector at one of the small holes. This takes a fairly big iron and a little time, because the body shell carries heat away quickly. When the connector metal is hot enough, melt a little solder into the hole. Turn the connector and repeat at the next hole. Again, leave no blobs of solder. If you do run too much solder onto the connector, melt the blob with the soldering gun and shake off the excess while the solder is still fluid. The tinning you did in step 5 helps the solder bond quickly with the shield braid inside the connector.

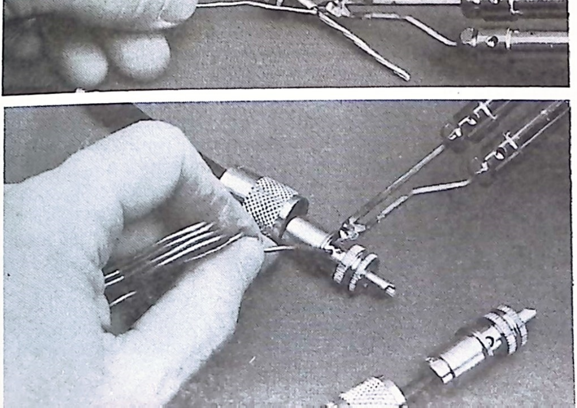
Don't mess with the connector while it's still hot. Cable insulation inside is still soft and could be damaged. Only after the connector cools (which takes several minutes) is it ready for use.

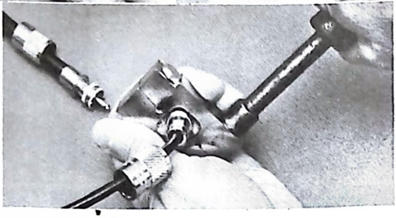












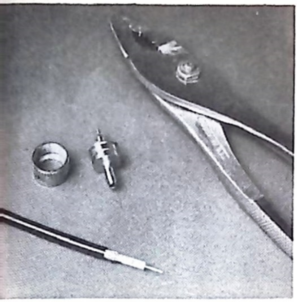
As a substitute for soldered or solderless connectors, you might like the crimped type. If you have a relatively new antenna, chances are good that it came with a machine-crimped connector. However, *Gold Line* makes a crimping tool you can use with any standard PL-259 connector. It costs around $5, and is easy to use.

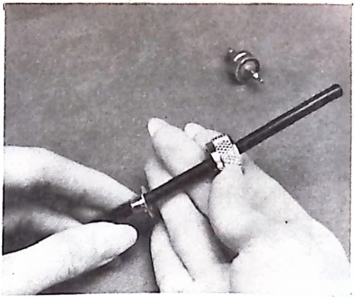
You prepare the cable as outlined in steps 1 through 7 (pages 60 through 63) for soldered connectors. From there on, use the crimper in place of a soldering iron.

You use one of the small holes in the crimper to crimp the connector pin onto the center conductor. Clip the center conductor flush with the pin tip. Use one of the tiny metal filler plugs supplied with the crimper. If you don't have those, RG-58/U takes a snippet of No. 10 AWG solid wire; RG-8/U takes No. 14 AWG. These filler plugs are crucial; without them, the connector/cable joint has little strength. Stick the filler plug into the pin before you crimp. In an emergency, slide pieces of center conductor wire (which you clipped off) into the pin. The idea is to pack the pin so you can get a tight crimp. Stick the pin into the small crimper hole. Tighten the bolts till the jaws are completely closed, to accomplish the crimp on the pin.

Notice the crimper has a large hole in the center. Open the jaws of the crimper wide. Insert the connector body into the center hole. Close the crimper around the small barrel offset of the connector (the skinny part with the portholes). Again tighten the bolts at either side of the crimper, closing the jaws as tightly as you can. If you have a weak fist, clamp the crimper in a vise to hold it steady and give you more leverage. Use a hex nut-driver, wrench, or ratchet. The crimp must be tight.

Properly crimped connectors hold up much longer than solderless types, and practically as well as soldered ones.





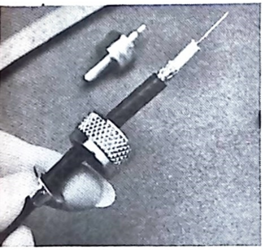
At least three companies distribute what's termed a "pliers-applied" connector. It's a new variety of crimped connector, rather easy to install. The connector has only two or three pieces for you to contend with. You'll need the usual razor blade or pocket knife, slip-point or Channel-lock pliers, and wire cutter. This type of connector appears shorter than the conventional PL-259 connector. But it carries similar standards of performance.

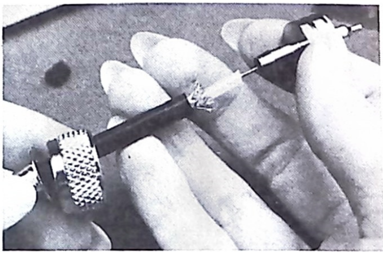
(1) Disassemble the connector. Slide the slotted ferrule flange onto the cable first, and then the threaded coupling ring. Push them back out of your way.

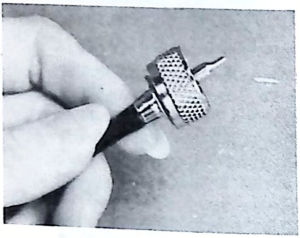
(2) Pay close attention to these measurements. About 1/2 inch from the end of the cable, cut through the cable sheath, the braid, and the inner insulation. DO NOT nick or cut the center wire. Twist the loosened parts with pliers to free them from the center conductor, and slide them off. Move the blade 5/16 inch back along the cable sheath. This time, cut through the sheath and braid only. Strip them from the white inner insulation. Move another 3/16 inch back along the sheath, and remove sheath only. Do not nick or cut the braid.

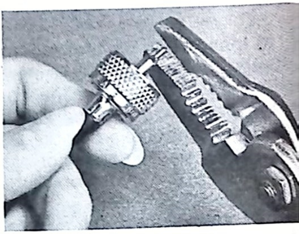
(3) Fan the braid open slightly.

(4) Push the connector body onto the cable. With the type shown here, slide the tapered end of the connector body between the braid and the inner insulation.







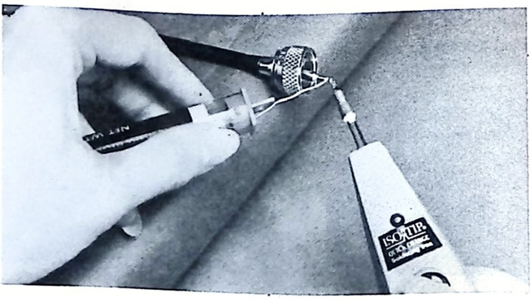


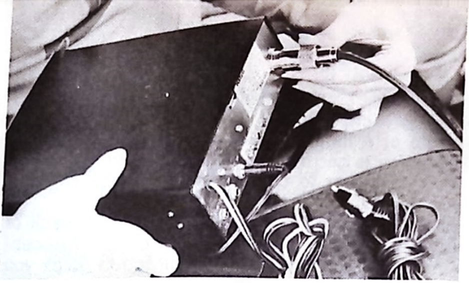
(5) When you have seated the connector body fully onto the cable, the braid flares out over the flange of the connector.

(6) Slide the coupling ring down over the connector body. Thread it into place.

(7) Notice the bulge in the cable caused by the barb in the connector. That's what locks the ferrule flange in place. Slide the ferrule down over the connector until it snaps into place.

(8) This step can be omitted, depending on whether you want a permanent or temporary installation. Snip off any wire extending beyond the tip of the pin, if the pin is open. For a permanent connection, take your pliers and crimp the pin onto the cable's center conductor. Squeeze hard. Or, if the tip is open, heat a little solder into the pin.





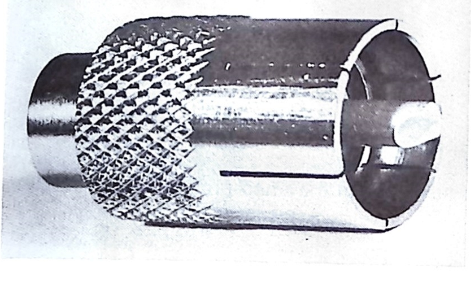
While you're dealing with connectors, here's something else to consider. If you use your transceiver in any kind of vehicle, you should remove the radio from sight when you get out. Connecting and disconnecting gets to be a nuisance. You can quicken the process with fast-disconnect power plugs (see Chapter 7) and a *slip-on* PL-259 coupling ring.

You can use this slip-on coupling ring with RG-8/U or RG-58/U (also RG-59/U) cable, as long as they terminate in a PL-259 connector. It also fits most soldered or crimped PL-259 connectors.

Here's what you do. Instead of sliding the regular threaded coupling ring onto the cable at the start of installing a connector, substitute the slip-on-type ring. The remaining steps for installing the connector remain the same.

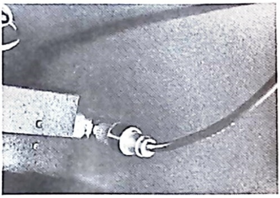
If you already have a PL-259 connector on your antenna cable, screw the coupling ring off the connector body. Slide it up the cable out of the way. You can screw the slip-on coupler onto the connector body threads from the front. That's it. Now it takes only a few seconds each time you want to connect the antenna cable to your transceiver—even less to disconnect.

If you're in doubt as to whether the slip-on coupler gives you a dependable connection . . . don't worry. It fits snugly on every transceiver that takes a PL-259 connector. It does not alter standing-wave ratio.

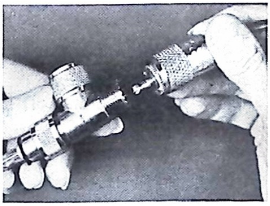


Sometimes you run into situations where you need something unusual for plugging a cable into a transceiver. For example, you put a CB radio or a ham transceiver into your car, boat, truck, or RV. The space is narrow. You wind up without enough room behind the transceiver to connect your antenna without crimping the wire unduly.

Buy a right-angle PL-259 adapter. Screw it onto the back of your transceiver at the antenna terminal. Point the open receptacle to the top, side, bottom, or whatever direction gives you the most room. Attach the regular PL-259 antenna coax connector in the usual way.



You might also decide you need a PL-259 T-adapter. These often create more problems than they cure. If you don't know how to calculate and combine cable impedances properly, you'll end up with a mismatch. That deteriorates your communications—and could damage some transmitters.



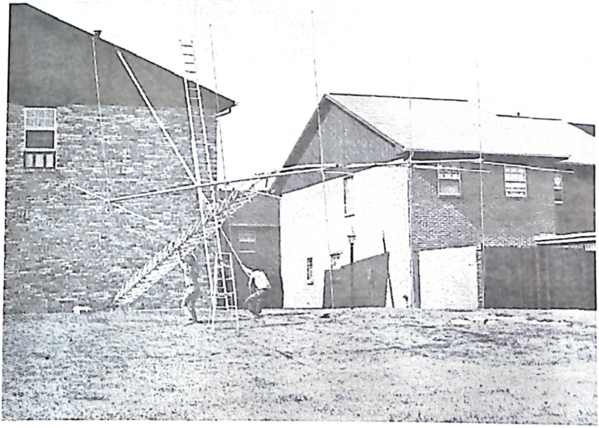
The coaxial cable network is vital to your two-way radio antenna system. It operates without bother, if you handle it properly from the start. However, cables that take a beating do wear out. So don't hesitate to run new cable when necessary. You have all the basic how-to knowledge in this chapter. For problems not solved here, call in a trained professional.

CHAPTER 5

Base Station Antenna Accessories

How far can I communicate? That's the question of prime importance to most two-way radio operators. Many operators, particularly CBers, try to gain distance by adding pre-amps and illegal power amplifiers to their systems. They're working on the wrong elements. The key to real communications distance, on the vhf two-way radio frequencies, lies in *antenna height*.

In the pages that follow, you see different ways of getting your antenna "up there." After you manage that, then you'll want to know about various accessories for your base antenna. While these accessories do not necessarily add much distance to your signal, they do make your signal stronger—and therefore more intelligible at its far limits.



The most reliable way to place your antenna as high as you want it (and can legally put it) is a tower. Typical towers for communications come in 10-foot sections. You can construct a 30-foot, 70-foot, or 150-foot tower.

As you may know, a CB antenna can extend only so high. You can mount an omnidirectional antenna higher than a beam. An omnidirectional base station antenna, whether on pipe mast or tower, can reach 60 feet above the ground. However, a beam antenna is allowed only 20 feet above its nearest obstruction. In both cases, you measure to the highest tip of the antenna, not just the support.

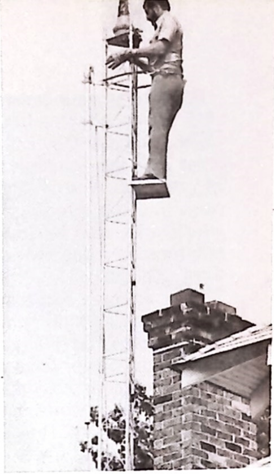
Here's an example. If you live in an apartment building five stories high, its roof reaches to 60 feet or so. Try for permission to mount your two-way radio station antenna on the roof. You can't go 60 feet above the roof. But you can erect either kind of antenna (omni or beam) to extend 20 feet above the *highest point* of the roof.

There's no limit on antenna height for Amateur Radio operators (you lucky rascals). However, any antenna over 200 feet needs approval from the Federal Aviation Administration as well as from the Federal Communications Commission. The laws may require you to paint and light your antenna tower, just as they require commercial broadcast stations to paint and light theirs.

With Business Radio, antenna height often is regulated by the distance you need to cover. This information goes on your license application. The FCC will then tell you how much power and how high an antenna you can have.

Airports nearby present a problem. A special formula applies to your planned Ham or Business Radio antenna. You must file special forms with both federal agencies. Your antenna cannot be in the path of any aircraft runway, whether commercial or private airport or heliport. You'd do best, at the outset, to consult a radio communications specialist about this requirement.

There's one way you can circumvent the height limit on Citizens Band antennas. If you hold an Amateur Radio license *as well as a* CB license, you can erect a tall tower for your ham radio. Then, just add a sidearm to the tower, near the top. On that sidearm, hang your CB antenna.



Towers most suited for your station are self-supporting up to a moderate height. Any good tower won't topple under normal circumstances. But you must think ahead to *abnormal* conditions—windstorms, earth tremors, ice storms, hurricanes, and the like. Tower manufacturers can guide you to a tower that would support your intended antenna. Consider additional support for the tower.

You should also consider your own safety while installing the antenna and tower. First and foremost, avoid electric wires. Place your tower so that no matter what direction it might fall, it cannot strike power lines—not on your roof, your neighbor's roof, or near the street or alley. Temporarily spot a section of tower at your desired location. Then pace off the height of the tower in every direction. You don't want the expense of repairing a neighbor's property.

Inspect any roof on which you'll be working. Note the location of all wires and metal gutters and pipes. Contacting metal while you hold a faulty power tool could be fatal. Use only grounded cords for your power tools. Or plug into an outdoor socket that runs through a *ground-fault interrupter* breaker. If something goes amiss on a GFI-protected circuit, the breaker instantly opens. It prevents electrocution.

Consider the pitch of the roof and the condition of roofing. If a roof is steep, or its materials rotten, stay off. Even on normal roofs, take precautions. Set a scaffold. Or, with ropes, anchor a ladder flat on the roof. This serves as a foothold and a place to stack your tools. Move carefully while on any roof. If it's your house, fix any roof defects before climbing around on it for antenna work.

Add gloves to your safety equipment. Heavy rubberized gloves protect you from rope burns, and sometimes from electric shock (where GFI isn't available). Rent a safety belt if you can't beg or borrow one. Wind gets treacherous, even at 30 feet above the ground. If you're building a tower, use a working platform for both safety and convenience.

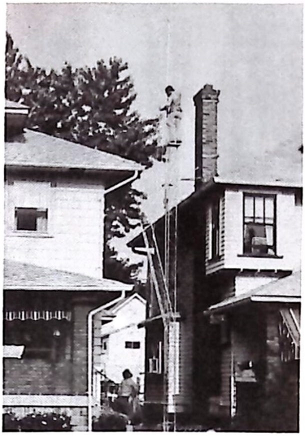
Remember, your two-way radio antenna concerns your neighborhood. Its effect is both esthetic and electronic.

For example: Don't place your antenna within 30 feet of any other antenna—radio or TV. Cross-radiation and interference can develop. Your neighbors won't want your radio transmissions to come through on a TV or stereo. For CB in particular, interference can be an FCC violation. Complaints about your interference mean more work for you, plus pressure you don't want or need.

Your antenna can also pick up noise when it's too close to power lines. In high humidity and stormy weather, arcing could occur, which can totally ruin your radio gear. Keep your antenna as far from power lines as possible.

A (sometimes) less dangerous hazard is neighbors. If a lot of children live in your vicinity, put anti-climb shields on the first section of tower. They prevent active, adventurous kids from climbing on your tower and possibly getting hurt in a fall.

Consider your neighbors when locating your tower too. Pay careful attention to property lines. If part of your antenna crosses over, get your neighbor's permission, in writing and witnessed by someone else. Check zoning ordinances. Trying to explain your tower to the police or judge after the fact wastes time and money, and brings public embarrassment. Moreover, should your neighbor move, the release might head off a feud later on. If a neighbor fails to grant permission for your tower, find another way to mount your antenna.



Antenna towers should be solid and sturdy. Not all makes are. Protect yourself and your investment. Buy towers made by companies with products proved by years of solid service—*Unarco-Rohn,* for example.

Talk to other radio operators who have towers. Frequently, those who bought off-brands had trouble getting the thing together; they'll tell you about it—emphatically. Don't be kidded that a good tower can be put up by children or by one lone person.

Some towers won't hold up in strong winds, especially with a heavy beam and rotor on top. Read tower specs. Find out wind and stress limits for towers you're considering. How close together are braces? Are braces welded properly to the poles? Can the tower rust?

Having bought your tower, set up a construction schedule to follow—weather (and wind) permitting. Constructing a tower takes time, sweat, and patience. *Get help.* You need at least one more person, and two is better.

The initial step is setting the base—usually in concrete. Do that several days before you plan to erect the tower, so the concrete can "set." Plan to spend a full weekend raising the tower. With experience you could do it in one day. Allow another day or two (probably the following weekend) to assemble and hang the antenna.

Before you dig a hole for the tower base, look in the basement for incoming water, electric, or gas pipes that enter through the foundation. Phone utility companies, if you have to, so they can show you where lines are buried. Don't dig until you're sure the spot is clear of pipes, sewer systems, phone wires, and power cables.

The tower how-to sequence photographed for you here involves a tower with foldover base section. For a solid tower, always set the base in concrete. Dig a hole 2 feet square by a little less than 3 feet deep. With this fold-over base, you must leave the hinges clear of the cement. Loose soil in the bottom of the hole can help you set the base approximately level before you add the concrete. In hard soils, add 6 inches or so of sand in the bottom of the hole to help stabilize the base.

After digging the hole, bolt the base and first section together. This spaces the base hinges properly for the tower legs. Orient the legs so the hinges will let the tower down in the direction you wish. Jam the base, tower still attached, into the soil at the bottom of the hole.

Place a carpenter level vertically along one leg of the tower. Wiggle the tower around until the legs are straight up and down —precisely vertical. If you set this section crooked in the concrete, the entire antenna will stand lopsided (and weak).

Pour concrete into the hole around the tower base. You can mix your own concrete or buy a bit from a ready-mix company. Fill the hole about a foot at a time. "Puddle" each pouring by poking a shovel repeatedly into the concrete in the hole. Puddling works out air bubbles which weaken the concrete—and thus the installation.

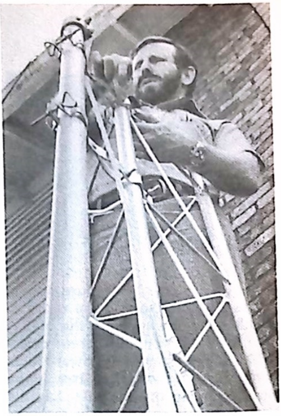
When you've completely filled the hole with concrete, pour a little more and smooth it for a slightly "domed" top. Then sprinkle on some water to keep the concrete moist on top while the inner portion sets. IMPORTANT: For the first half-hour, continue to check the legs with the level. If the tower section begins to settle off the vertical, correct it before the concrete sets.

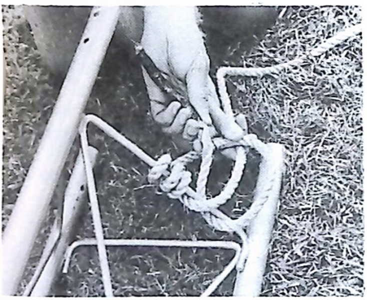
Let the concrete base cure for at least two days. Then you're ready to assemble the tower. Take the bolt(s) out of the hinge on the corner opposite the direction the tower folds down. Loosen the other two hinge bolts, but leave on the nuts. Lay the bottom section down. Slide the second 10-foot section onto the first.

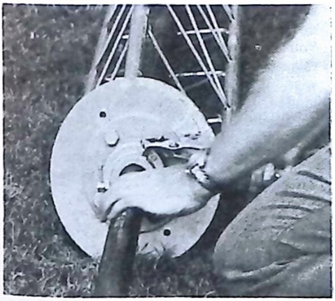
Bolt the sections together. If there are two bolts for each leg, use them. With some tower models, one bolt is larger than the other. Watch that you don't put a small bolt into a larger hole. Tighten the nuts on the bolts firmly, but not enough to bend the steel tubing of the tower legs, nor tight enough to strip the threads.

Add the third section and bolt it. Likewise the fourth, if you're going to 50 feet. Do not add the top section yet, the one that tapers to a point or a plate. That section goes on best with the antenna already attached, and works into position easiest with a gin pole (next page). Tie a rope to the tower, somewhere more than halfway up. Rig it with a bowline knot, if you know how; the rope needs to be secure, but easy to untie later.

Run the rope to a pulley block attached to the roof eave or a convenient chimney. You need this leverage. Two men can manage to push up 30 feet of tower, but it's a strain. You'll need some way to lower and raise the tower later, anyway. Otherwise, there's no point in having it hinged. (When it's not hinged, you set the bottom 10-foot section 3 feet into concrete, and use a gin pole to erect each subsequent 10-foot section.) Tighten all three (or six) hinge bolts.







A gin pole consists of a 12- or 14-foot hollow pipe, a pulley at one end, a strong rope, and brackets to clamp it to the tower leg. With the gin pole, you can raise one section of tower above the one you're standing on; the gin pole supports it while you align the tower legs and lower the section into place. The gin pole pictured opposite is home-made; you can buy professionally made gin poles from some tower companies.

Start by sliding the gin-pole bracket to the end with the pulley. Climb onto the tower. Attach the gin pole to one leg at the top of the first section.

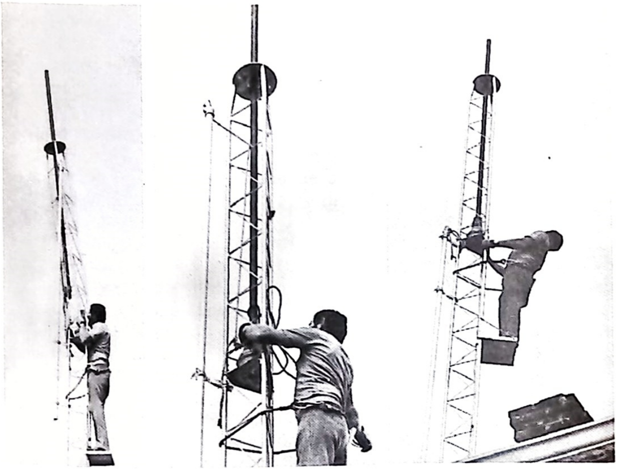
Rig the tower section to be lifted by first tying a "rolling hitch" on a crossbrace near the bottom. This hitch does not slip, yet unties easily. Both are important when you're handling a tower section 40, 50, or 100 feet in the air. Just wrap three or four turns of the rope around the bar. Cross the free end over the standing portion of the rope, then over the brace in the same direction as the wraps. Bring the end through the loop thus formed, and pull it tight.

At the other end of the section, form a half-hitch in the rope and loop it over one leg of the section. The "ground man" pulls on the rope protruding from the bottom of the gin pole, hoisting the tower section into position. The "high man" settles the new section onto the section he's standing on. When it's in place, he bolts it solid. The half-hitch lets him flip that part of the rope free without letting go of the rope end, after untying it. He sends the rope end back down to the ground man for another tower section.

The top two sections take a little extra work before you hoist either of them. Between them is where you situate the rotor, which turns your beam antenna. Some rotors fit inside the tower. Others, as the one you see here, are too large.

You need a thick-wall cold-water pipe for a mast to hold the antenna. Slide the pipe through the thrust bearing on the top tower section. Tighten the bolts in the thrust bearing to hold the pipe in place.

You'll need an accessory shelf for the rotor. It goes on the next-to-top section. Bolt it to the legs so it rests on the top braces of the section. Before you send this tower section into position, wire up the rotor (pages 79-81) and bolt it to the accessory shelf.

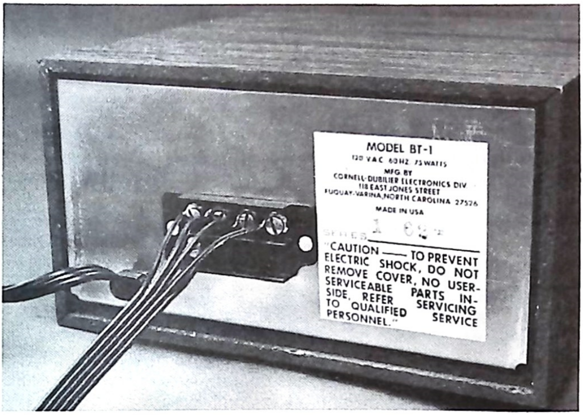


Raise the next-to-last section into place with the gin pole. It and the top section are a bit unwieldy, with extra weight on them. Don't do them on a windy day; they could become difficult to control. You could get shaken off the tower.

For the top section, rig an extra rope to hold the heavy mast pipe so its end is up inside the section. Hoist this final section up and bolt the two sections together.

Loosen your end of the mast rope, and lower the mast into the rotor. Bolt the mast in place with the rotor U-bolts. Remove the mast-rigging rope, disengage the gin-pole rope, slide the pole down, and lock it, take the clamps loose, and send the gin pole to the ground.

Before you climb down, inspect your work. Shake the tower. Watch for vibration, particularly at section joints. Tighten any bolts you missed. When the tower and rotor feel stable, you're done until you add the antenna.


MODEL BT-1
120 VAC 60HZ 75WATTS
MFG BY
CORNELL-DUBILIER ELECTRONICS DIV
118 EAST JONES STREET
FUQUAY-VARINA, NORTH CAROLINA 27526
MADE IN USA
"CAUTION —— TO PREVENT ELECTRIC SHOCK, DO NOT REMOVE COVER, NO USER-SERVICEABLE PARTS INSIDE. REFER SERVICING TO QUALIFIED SERVICE PERSONNEL."

Of course, with an omnidirectional antenna, you don't need a rotor. But a beam antenna must be pointed in the direction you want your most powerful and sensitive communications. The larger your antenna, the bigger (stronger) the rotor you need. Not only does a rotor turn the antenna, it must also stop it. Antennas with a 30- or 40-foot boom need a heavy duty motor *and brake,* like the *Cornell-Dubilier* Ham II (eight-wire). For smaller beams, a five-wire rotor should suffice.

No matter what the size, adding a rotor to your antenna requires the same steps—wiring the rotor, mounting it on the tower, attaching the antenna, securing the cable (as you climb down), wiring the rotor control, and calibrating directions.

First, the wiring. Five-conductor rotor cable is flat; eight-conductor is round. Since each wire has a specific function, you'll find the rotor wiring strip and the control box strip both numbered. With flat cable, be careful not to turn the cable over between rotor and control. One wire is silver, as a key. Each conductor in eight-wire cable has different-color insulation. Write down what color you put on which numbered terminal at the rotor. Then duplicate that sequence at the control. Larger rotors need two wires heavier (bigger) than the others, for motor and brake. Wiring instructions with the rotor tell which terminals get the heavy wires.

Gather all the rotor parts and cable together. Keep small items in a box or lid. You'll probably do the work outside, and small parts dropped in the grass are hard to find. One bounce and they're nigh impossible to retrieve.

Slide the rubber grommet and inspection plate onto the rotor cable. Push them up the cable and out of your way. String the cable through the inspection hole on the mast support bracket, which is not yet bolted onto the rotor itself. Remember to bring the wire from bottom toward top, or you'll have it to do over. Pull a couple of feet of cable through the mast support bracket. You need slack to work with. Slide the mast support back out of your way for a while.

If you're using flat cable, separate the wires back for 3 inches or so. Strip about an inch of insulation from each conductor. With round cable, you peel back 3 inches of outer cable covering. Then strip 1/2 inch of insulation from the end of each wire.

Attach the wires to the terminals on the rotor. Begin with terminal number 1. Twist the strands together, and wrap the bare end of each conductor around a terminal screw, and tighten the screw. Remember to makes notes of which wire goes where. Clip off excess bare wire.

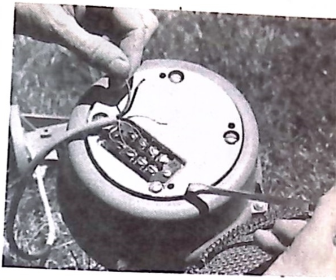
Now fit the mast support bracket to the rotor. Do not pinch the cable between the rotor and the bracket. Spacers may be provided; if so, use them. Bolt rotor and support bracket together.

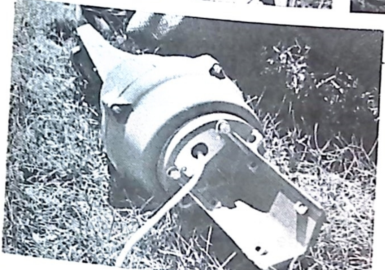
Scoot the inspection plate and grommet up the cable to the bottom of the bracket. Fasten the inspection plate over the terminals. It protects terminals from weather. Fit the grommet into the hole around the cable.

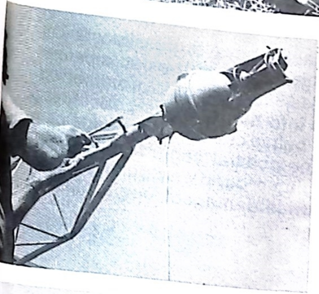
From the outside of the mast support bracket, stick two U-bolts through the support. Slide mast clamps onto the U-bolts. They go two ways; choose the one that fits the tower or mast you'll put the rotor on. Then lockwashers and nuts. Slide the rotor onto the mast pipe already in the antenna tower, or to the tower top itself if the rotor fits. Tighten the nuts on the U-bolts, to clamp the rotor in place.

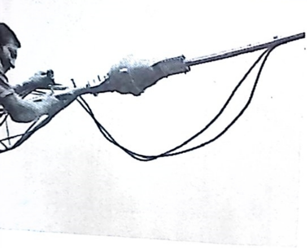
Don't leave rotor cable dangling. Leave some slack at the rotor to keep the weight of the cable from tugging on the terminals. Fasten the cable to the top section of tower with plastic tape. Tape the cable every few feet down the tower length.

Prepare the rotor's antenna mast bracket with U-bolts, clamps, lockwashers, and nuts—just as you did on the lower bracket. Slide the antenna mast into the rotor. Tighten the clamps. Drape enough antenna lead-in cable around the rotor









to allow the antenna to make one full turn without straining the cable.

At the control box inside, wire the rotor conductors to the same numbered terminals as you did on the rotor. Plug the rotor control into ac power.

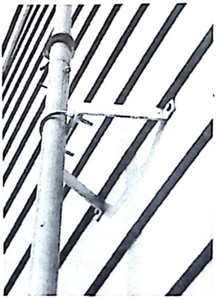
Towers, of course, aren't the only way to get your two-way radio antenna up high. For an omnidirectional antenna rather than a beam, the push-up (telescoping) mast or pipe-and-gable bracket might be more practical. After situating your transceiver, mount the pipe mast as close to your radio set as possible. Observe the same precautions that you would in locating a tower (pages 71 and 72). Hint: Gable ends of the house let brackets reach higher, so the pipe mast—and your antenna—can be taller.

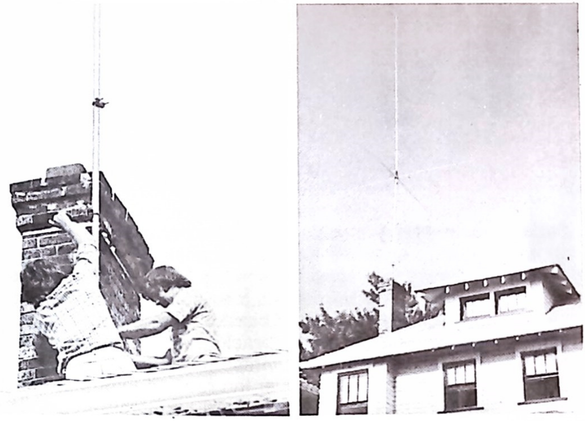
Pipe masts need support, usually a little more than just sticking the bottom of the mast in the ground. Setting it in (or on) a square foot of concrete adds to support. Bracket a pipe mast to the house or building every 10 feet up to the eaves. U-bolts hold the mast to the brackets. Use anchor bolts or lag screws to secure the brackets. Lag screws must go into the solid wood of studs. Or, in the case of bricks, into lead expansion sheaths that grip between brick layers.

If the mast is supported entirely above ground by the brackets, not resting on a solid base, set the first bracket 4 to 6 inches above the bottom end of the pipe. Bracket again about 5 feet up, and so on. Holding up the weight of mast and antenna takes extra brackets. Where the mast passes an eave, bracket there also.

Shorten the antenna cable distance wherever possible. If you drill a hole through the wall, put a grommet on the cable before feeding the cable through the hole. Slide another grommet on the cable inside. Fit the grommets into the holes on both sides. Grommets protect the cable from being cut on sharp edges.

Use cable ties or tape to hold the coaxial cable to the mast. This prevents the cable from whipping around and pulling loose from the antenna or getting otherwise damaged.





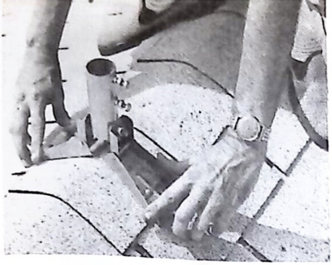
You can also gain height for your antenna by using your roof. Common mounts for the roof are chimney mounts, tripods, and saddle or hip mounts.

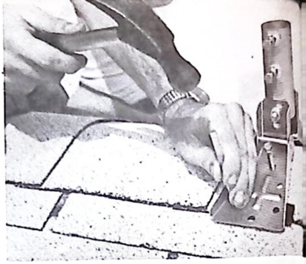
Chimney mounts are the easiest to install. They come with two steel straps and brackets. You add a pipe mast. Don't attempt to operate a beam antenna from this or any other roof mount. None of them, as a rule, are strong enough to handle the heavy boom and rotor, especially in a high wind. And don't buy cheap chimney-mount kits. They just rust out. You either replace them yearly or expect antenna damage.

Before you mount a chimney bracket, inspect the chimney. Don't hang an antenna on a crumbling chimney, or where the mortar between bricks is chipping out. It's dangerous. Chances are, the first bit of severe weather that comes along will destroy both chimney and antenna.

Position the straps around the chimney. Wrap the two straps parallel and as far apart as the chimney will allow. Slide U-bolts into the brackets. Secure the straps in whatever way that particular model provides. Set the mast up, with the antenna already mounted on it. Slip the clamps onto the U-bolts. Tighten the U-bolt nuts at both the top and bottom strap.

Yearly, climb up and inspect the chimney, the mounting straps and brackets, the antenna, and the lead-in cable. Repair, replace, and tighten as needed.





Saddle-mount or hip-mount brackets also are inexpensive and easy to install. An entire hip mount consists of one jointed bracket with "flaps," and some lag screws. Your mast costs extra. So does the antenna, of course. You can use only omnidirectional antennas with hip-mount brackets, and you must guy the mast (pages 86 and 87). This bracket will not hold an antenna up without supporting guy wires.

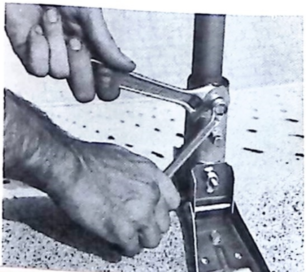
Set the saddle-mount bracket over the roof ridge or hip. Position it at the junction of a ridge beam and two intersecting rafters. This way, all the lag screws anchor into solid wood. You can find solid wood experimentally with an ice pick or nail set punch, if you remember to fill the unused holes with sealer.

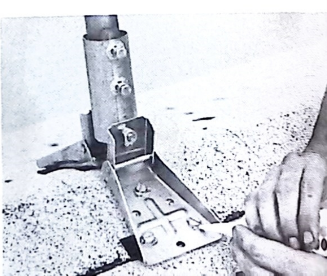
Use the bracket flaps as templates. Mark where to drill the holes in the roof. Take the bracket away. Drill just enough of a hole that you can start the lag screws into the wood.

Squirt some caulking—usually a silicone-type sealant—on the roof where the bracket will go. Place the bracket over the holes, and start the lag screws. Twist one lag screw until it bites into the wood for a couple of turns. Loosen the screw about half a turn. This relieves stress on the wood and helps prevent it from splitting. Twist the screw in a few more turns. Loosen it a turn. Continue this in-and-back-and-in process with all the lags until you've anchored the bracket tightly to the roof.

Seal around the edges of the mount and over the screws with caulking.

Set the mast and antenna in the bracket, with someone holding the pipe upright. Tighten the bracket setscrews to hold the mast. Arrange guying.





Tripod roof mounts take a bit more doing. Tripods vary in size from about 2 1/2 to 6 feet high. They straddle the hip or ridge of a roof. But unlike with saddle mounts, you'll have difficulty anchoring all the tripod legs into a beam or rafter.

Rule one: Never anchor any kind of roof bracket to just plain sheathing. On the roof. If you can't anchor in a beam or rafter, you'll have to devise reinforcement to spread the stress of the antenna mounting over as large an area as practical. Otherwise, chunks of roof could get ripped away in a windstorm. You can use a piece of 2 × 6 wood, at least 6 inches long, as reinforcement under each tripod leg. Or, you can use a 6 × 6-inch piece of thick sheet metal. You place these reinforcements on the underside of the roof (in the attic). Here's one way to position them correctly.

Position the tripod on the roof. Where you *can* anchor to a beam or rafter, do it. Use the foot or pod as a template. Mark and drill and lag and tighten as with a saddle mount (page 84). Seal under and around each foot.

Wherever a foot rests over a point that has no beam underneath, place the metal flashing or wood block under the pod in question (outside for right now). Centerpunch the block or metal for the necessary holes, using the pod as a template. Drill both the roof and the flashing with a drill that fit the holes in the feet.

From here on you need a helper. Someone must be in the attic under where you're working on the roof. Give your helper the reinforcement block or flashing, nuts (you have to use bolts instead of lag screws), flat washers and lockwashers, wrench, and caulking. Your helper must match the holes in the reinforcement to the holes in the roof. Have him squirt caulking between the reinforcement and the roof. On the roof, you should spread sealant under each pod to be anchored this way.

Slide the bolts through the holes. They must be long enough to go through foot, roof, and reinforcement, with enough threads left over for the washers, lockwashers, and nuts. Inside, your helper puts the washers and nuts onto the bolts. You hold the bolts steady with one wrench; he tightens the nuts with another.

Do this for each remaining foot. When you're finished, caulk around the edges of the pods and over the bolt heads.

Although tripods are sturdier than saddle mounts, most makers recommend guying, especially with antenna masts more than a few feet tall. See pages 86 and 87 for that.

Guying refers to the practice of stringing wires at strategic points to stabilize an antenna mast or tower, or to hold it upright. Guying does not add strength to the mast, only support for it. Masts in saddle mounts need guying. You should also guy masts in tripods, and taller towers need the added support.

The best material for guying is seven-strand extra high strength (EHS) aluminum guy wire. Accessories you need are: eye bolts or screws, turnbuckles, strain-relief thimbles, cable clamps or guy grips, and a host of miscellaneous hardware. Screw-in ground anchors hold the ends of guy wires for a tower in a field.

Preferred practice says to guy an antenna pipe mast every 10 to 15 feet. Use three wires per level. Arrange the guy anchors every 120 degrees around the mast or tower, and as far from the base as practical.

A pipe antenna mast calls for one guy ring or collar for each 10 feet of mast. Clamp one ring about 8 feet up, the second about 18 feet, and so on. (Don't go over 30 feet with a pipe mast.)

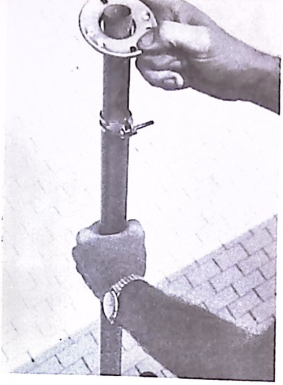
Set three screw-eyes into the roof, angled 120 degrees apart around the mast. No anchor should be any closer to the mast than 8 feet for each 10 feet of height. Example: anchor the 20-foot level of guys at least 16 feet away. The 10-foot level can go to the same eyes (but not the 30-foot level). Screw the eyes into solid rafters, or beams, or use eye bolts with reinforcement (as described on page 85).

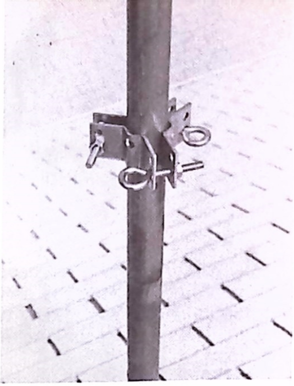
Clamp a jaw-and-eye turnbuckle to each anchor eye. A "replacement link" for small chains makes an excellent fastener, and is easy to use. Hardware stores have them.

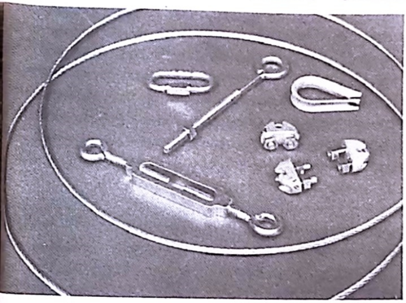
Thread one guy cable through the ring on the mast at the first level. The wire takes less wearing if you thread it around a U-shaped thimble, which you've placed in the guy-ring eye or hole. Pull through an extra foot before you cut the wire. With three cable clamps—spaced about 3 inches apart, secure the mast end of this guy wire.

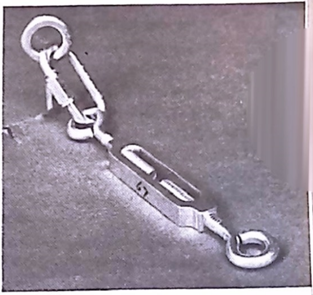
Open the turnbuckle at least a half-inch at both ends. With someone holding the mast upright, run the guy wire through the eye bolt of the turnbuckle. Use a thimble for the neatest and most durable installation. Again cut 12 inches extra. Fasten the tail with cable clamps as above. Make new guy wires as taut as you can. They'll stretch in a few days, and you may have to twist the turnbuckles tighter. Follow this same procedure for the other two guys at the first level. The guy wires now support the mast.

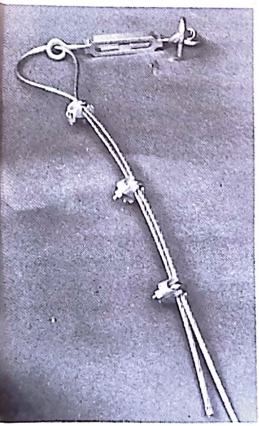
To attach second-level guy wires, unscrew one turnbuckle and lay the mast down. Estimate their length, cut, and attach all





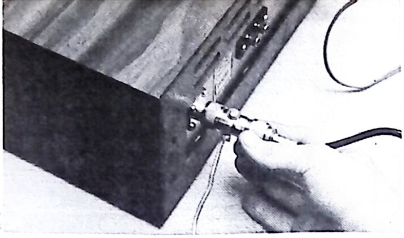






three at the mast. Raise the mast, and refasten the loose first-level guy. Proceed to anchor all three guys at the next level. Repeat this for the third level.

You use this same basic method for guying a tower, except that you need ground anchors. For greatest strength, set these ground anchors at a 45-degree angle in concrete piers. When cutting your guy wires, allow an anchoring tail about 6 percent of the length of the guy.



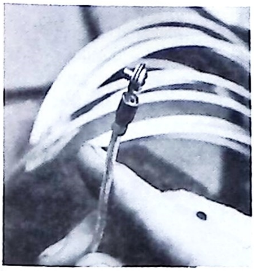
Another accessory your base antenna needs is a lightning arrestor. A few more costly antennas have a lightning arrestor with the installation kit. Many two-way radio dealers sell lightning arrestors, so you can include one as part of your base station "package."

A lightning arrestor keeps high static charges from building up on your antenna. Lightning is therefore not so apt to strike your antenna. With a nearby strike, you might sustain some damage, but not like you might without the arrestor. A lightning arrestor diverts much of the shock to a ground stake.

The lightning arrestor you see here is common. It fastens onto the back of the transceiver between the set and the antennna cable. On the side of the arrestor body, you fasten a ground wire. For some arrestors, a terminal screw tightens down to hold the ground wire. On other varieties, the screw is stationary; you loop the ground wire around it, and tighten a nut.

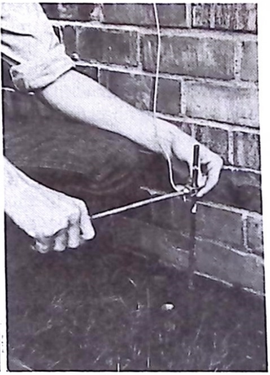
The ground wire is soft aluminum. It runs between the lightning arrestor at the transceiver and the ground stake outside. Crimp a ring lug (opposite page) or a spade lug onto the ground wire. That makes a better connection at the arrestor. You may have to file down the end of the wire so it can fit into the crimp channel of the lug. Remove the screw and washer from the arrestor. Slide the ground-wire lug onto the terminal. Tighten the terminal, washer, and ground lug on the arrestor. Attach the arrestor to the transceiver, and the antenna cable to the arrestor.

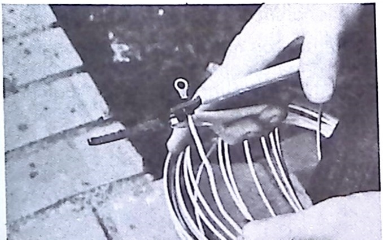
The ground stake is your real surety in a lightning protection system. It must be 4 to 6 feet long, and made of conductive metal such as copper or aluminum. Your two-way radio dealer should have them. Drive your ground stake into the earth at a point near your transceiver. Make sure the soil where you're

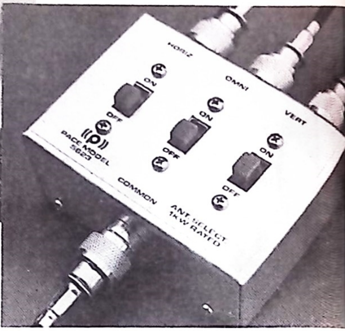


driving the stake is free of gas and water pipes, utility cables, and sewer tiles. Pour water on the ground around the stake as you drive it. That softens hard earth, and firms the contact between earth and stake.

Run the ground wire from the transceiver to the ground stake as directly as possible—no turns, bends, or corners. Wrap the ground wire around the screw terminal on the stake, and tighten the screw. Clip off excess ground wire beyond the loop.







If you're really into two-way radio, you may have more than one antenna and transceiver. Is this multiplicity of equipment in your radio room, or scattered all over the house? You may have more antenna cables draping around your walls than you know what to do with. Here's one solution—a *coaxial switch.* Whether you have one transceiver with two antennas, or two transceivers and one antenna, or two transceivers and two antennas, a coaxial switch helps you sort them out.

As an example, let's say you have one transceiver. Outside stand two antennas—an omnidirectional and a beam. That's handy. You listen with the omni until you get a call and identify where the caller is. Then go to the beam and zero in for clear communications. But fiddling with antenna connectors is a drag. Simplify your changeover with a two- or three-position coaxial switch. Plug your antennas in at the ends of the switch. Connect the other socket to your transceiver with a short coaxial jumper cable. You're in business.

Position 1 selects your omni antenna. Monitor with it. When you hear someone you want to talk with, switch to position 2 and rotate your beam to whatever direction gives the best reception. Call for a break and you'll get through.

What about one antenna and two transceivers? Use the coaxial switch almost like a twin-rig coupler (page 92).

Three-position coaxial switches have one position grounded. It prevents lightning- or static-caused discharges from trampling through your transceiver input circuits. The switch, if you move the selector to neutral, shorts out the antenna connections.

If you have a super-duper setup, you may need a five-position coaxial switch. You can mix and match antennas and transceivers with a flick of your switch. It's that simple, and convenient.

Anytime you have trouble "getting out" with your transceiver, suspect a high standing-wave ratio—something more than 2:1. If your vswr measures high, one cure may be an *antenna matcher.* It's especially useful with base antennas, where "tuning" adjustments to the antenna itself are difficult or impossible. The matcher adjusts impedance of the antenna system to match your transceiver output circuit. When you get a match, vswr drops 'way down. You can expect better performance then from your two-way radio equipment.

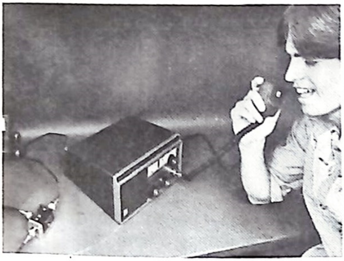
To make an antenna matcher do your job, you also need a vswr meter and two coaxial connecting cables. Unscrew the antenna coax from the transceiver. Attach one end of the short cable to the transceiver, and its other end to a vswr meter. Use the second short cable to connect the vswr meter to the antenna matcher. Connect the antenna cable to the other side of the matcher.

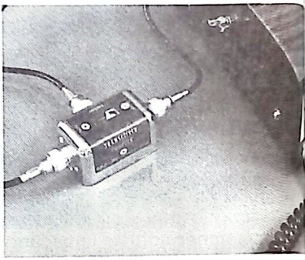
Turn on the transceiver. Press the mike button for a few seconds. The reading on the vswr meter indicates how mistuned your antenna system is. The matcher has two control knobs, sometimes labeled.

Use the *Tune* knob for the first adjustment. Twist it to lower the standing-wave ratio slightly. Don't expect to reach the minimum vswr at this point. Release the mike button. You'll be throwing a carrier on whatever channel you're using, so go easy on holding the mike button down. Turn your attention to the second knob, usually labeled *Load.* Key the transmitter again. The adjustment should lower the meter reading a little more.

Work back and forth between the two knobs until you attain the lowest possible vswr reading. If you cannot reduce the standing-wave ratio to less than 1.5:1, swap the antenna cable and the short cable to opposite ends on the matcher. Go through Tune and Load again.

Certain deluxe antenna matchers have a vswr bridge built right in. With these, you need only one short connecting coax, and *no* external vswr meter. Connect the antenna-matcher/power-meter between your transceiver and antenna cable. Tune as just described or as directed by the meter instructions.





A twin-rig coupler divides the use of one antenna between two transceivers. You could have one transceiver in the house, and another in the garage. One switch position on the coupler ties the house transceiver, which connects to the Output 1 socket, to the antenna, which connects to the socket at the rear of the coupler. The second position ties Output 2, which is for the garage transceiver, to the antenna socket. A third position, centered between 1 and 2, ties the antenna to both transceivers, for monitoring either one. (Each radio can be tuned to a different channel.)

To hook up a twin-rig coupler, attach the antenna cable to the socket behind the Antenna label on the coupler. Connect the number 1 transceiver to socket 1, using a short coaxial cable between Output 1 socket and the antenna socket on the back of the transceiver.

To the Output 2 socket on the coupler, attach a longer coaxial cable which runs from the coupler all the way to the antenna socket of the second transceiver. If the distance between house and garage is more than 50 feet, RG-8/U cable reduces losses.

WARNING: You can transmit from only one transceiver at a time, and you MUST have the coupler switched to *that* transceiver, NOT to the center position. Suppose you've been monitoring your favorite channel with the coupler in the center position. While you're in the garage, you hear someone you want to talk with. Go first and switch the coupler to the garage transceiver. That prevents heavy rf current from that transceiver getting into the other transceiver. Otherwise, your transmission could burn out the input circuits. Switch the coupler back to the center position when you're ready for both stations to listen again.

Some accessories are designed more for one communications service than another. A *mobile relay* or *repeater* is one such. And although members of a few Amateur clubs subscribe to relay service, it's more popular for Business and Industrial Radio. A repeater extends the range over which you can talk.

Vhf two-way radio signals do not follow the curvature of the earth. They go line-of-sight, or straight, and won't bend over the horizon. In a metropolitan locale, radio signals get sidetracked, blocked, and weakened by tall buildings. Hills impede communications with mobiles serving outlying territory. Situated high on one of the tallest buildings around, a well-placed relay/repeater circumvents these problems. It is an expensive accessory. Some repeaters carry up to 15 channels. Since most BRS and other land-mobile stations have only one or two channels, that means the relay can be used by several companies at the same time.

Relay stations are often owned and maintained by some Business Radio dealer within the community. This owner in turn rents channel "space" to companies that need communications. The dealer's technicians also service transceivers for the companies that subscribe to the relay service.

So okay, here's how it works. A company buys a base station and some mobile units. This company's trucks may cover a 50-to-150-mile radius from the main office. That's too much distance for ordinary vhf, so they subscribe to the relay service.

When it's time to reach a driver, the company dispatcher sends a signal as usual from the base transceiver on the channel or frequency assigned them by the FCC. Mobile units within range pick up this signal directly. So does the repeater outfit on top of that tall building downtown. The rooftop relay then amplifies and retransmits the signal, which now reaches all the mobile units within range of the repeater antenna. The relay setup forms a go-between for base and mobile units that are too far apart for direct radio contact. It works the same mobile-to-mobile, greatly expanding the service area of an ordinary two-way radio installation.

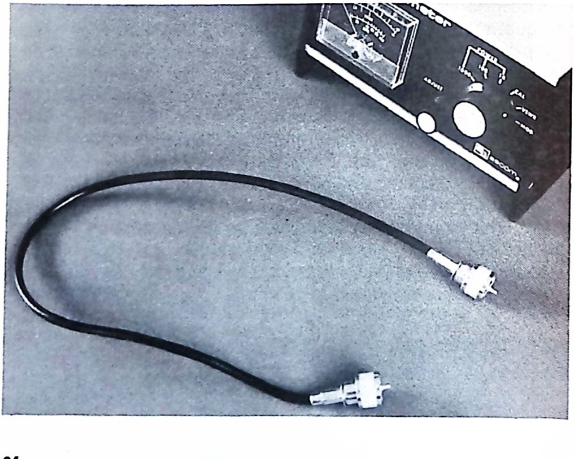
You can imagine stepping that a bit further. You may think, "Why not put several repeaters spread around the state, and increase our range tenfold." *Wrong.* Operating more than one repeater or relay in a system is called *ganging*, and that's illegal. Don't get greedy.

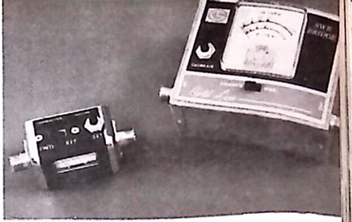
Almost every two-way radio accessory you use—meters, switches, whatever—requires a short piece of coaxial cable called variously a *jumper* or a *pigtail*. It's usually about 2 feet long, with PL-259 connectors on both ends. You can make up your own coax jumpers if you wish. All you need for each jumper is some RG-58/U cable and two PL-259 connectors. Use soldered or crimped connectors (pages 60-64). Make some of your jumpers longer than 2 feet, and some shorter. Two feet seems appropriate for most accessory hookups.

Of course, you can buy these cables very inexpensively at any two-way radio store. Some accessories that need them come with jumper cables included.

If you use a wattmeter or vswr meter permanently at your base, and another (possibly a mini-bridge) in a mobile unit, you'll need more than just one jumper cable. In fact, if you work much with CB or other two-way radio, you'll probably find regular uses for a half-dozen jumper cables. Keep track of them. Something always seems to pop up that calls for a coaxial jumper or pigtail. When fellow operators know who has several (or even one), they'll come a-borrowing.

In other words, of all the accessories you have for your two-way radio system, jumper cables are probably the most ubiquitous. They're definitely one of the most necessary.





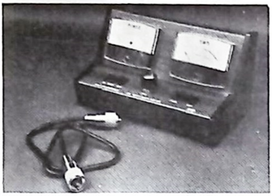
Every time you install an antenna, whether mobile or base, you must check to see if the antenna system needs to be tuned to match the transceiver. Antenna circuits of two-way radio transceivers exhibit a characteristic that's called *impedance.* It's expressed in *ohms.* Unless it's out of adjustment, or has a manufacturing defect, a transceiver comes from the factory with a 52-ohm impedance designed in.

When you assemble and install a station, there's no guarantee that the antenna, as constructed, has the right impedance. Good ones are designed for 52-ohms impedance, but mountings and other factors affect the actual value. Unless the impedances of both transceiver and antenna are closely matched, your two-way system can't work efficiently.

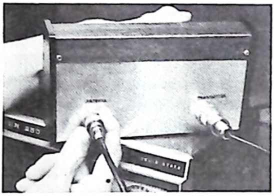
Your transceiver normally puts out all the power allowed by FCC regulations. That power flows from the transmitter output circuits through the coax (it's 52-ohm, too) and up to the antenna. When impedances anywhere along the way fail to match, the effect is as if part of the power gets "stuck" somewhere in the antenna system.

The "blockage" manifests itself in a sort-of voltage "lump," known as a *standing wave.* Of course you can't see this lump, although special instruments can find it. A more practical way to detect it, for you or any technician, lies in measuring the voltage standing-wave ratio (vswr). It's a ratio, computed logarithmically, between the voltage in the outgoing wave and that in the standing wave. Some people shorten this term to just swr, or standing wave ratio. Most meters measure the ratio loosely by comparing power supplied by the transmitter with power "reflected" from some flaw, like an impedance mismatch. But technically, it's vswr, and you measure this ratio with a vswr meter.

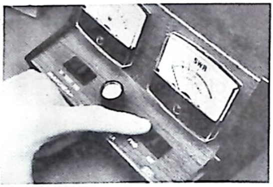
Your use for a vswr meter decides what type you buy. Some are elaborate and accurate, others inexpensive and make-do. You can relate vswr to antenna radiating efficiency. A mismatched or broken or poorly grounded antenna shows a high vswr. The higher the vswr the worse the fault, and the lousier the transmitted signal. A qualified technician can locate antenna defects and connector or cable faults, by intelligent interpretation of vswr readings at various points in your antenna system.



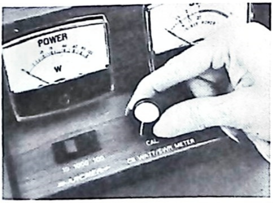
Whether you're trouble-hunting with a vswr meter in a mobile, or hooking one permanently to your base, you'll need a coax jumper to connect it up.



Disconnect the antenna lead. Connect the jumper cable between the transceiver antenna socket and the Transceiver socket on the meter. Attach the antenna cable to the Antenna socket on the meter.

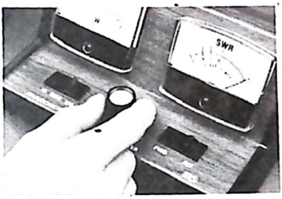


The meter has a FWD/REF switch. The abbreviations refer to Forward and Reflected. REV (Reverse) on some meters means the same as REF. Set the switch to FWD.

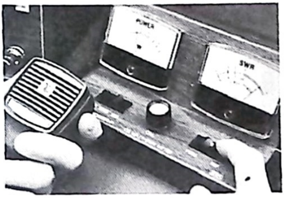


Turn on the transceiver. Make your measurements on a channel close to mid-band—channel 12 on a 23-channel CB outfit, channel 19 on a 40-channel. For ham or business transceivers, pick whichever channel you use most. Work with a channel that's not being used at the moment, whenever that's possible. Start with the CAL (Calibration) knob at its lowest setting.

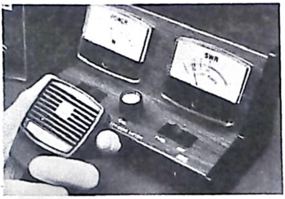
Having set the channel, key the transmitter (depress the microphone push-to-talk lever).



Advance the CAL knob until the meter pointer stands at full scale, or at the Set mark on the meter. Release the mike button after a few seconds. Don't touch the calibration control again during this test.



You have adjusted the meter so it reads 100% on power going *toward* the antenna. Now flip the FWD/REF switch to REF (or REV). The instrument now will read power being bounced *back from* the antenna (or from some fault in the cable or connectors).

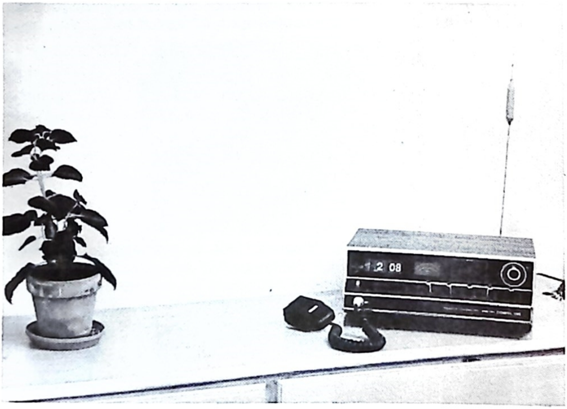


Key the transmitter again. This meter shows results on two scales—one representing what percentage of total power is reflected, the other marked directly in vswr. Normal is *under* 1.5 (expressed properly as 1.5:1).

Not everyone has room for an outside base antenna. Many apartment managers prohibit exterior radio antennas on the roof or beside the buildings. But what if you nevertheless want or need two-way radio communications?

Indoor base antennas offer a partial answer. They hardly do the job something outside could, but better and better models are becoming available. All you do is screw the indoor antenna into the antenna terminal on the back of your transceiver. Cheaper models may not be tunable; some recent types are, for peaking their performance. Vswr measures higher than with outside antennas. But vswr is hard to find accurately with this type of antenna. If standing-wave ratio doesn't show over 2:1, you're probably okay. You may also find that while you receive 5 miles or so with an indoor antenna, you may not be able to transmit more than a couple miles.

There are base accessories available that have nothing to do with antennas. You'll find those next in Chapter 6.

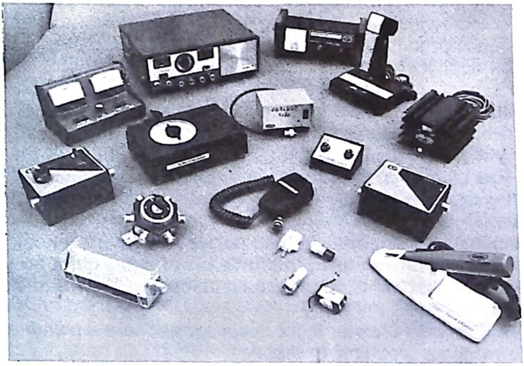


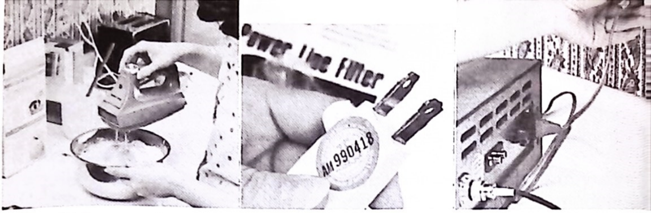
CHAPTER 6

Liven Up Your Base Transceiver

As you browse the communications stores, you'll find several accessories that connect to base transceivers. The most useful of these are presented in this chapter. You can buy accessories to utilize available power more effectively, to monitor signal strength, and to suppress noise and interference. Or you may want to limit the units you contact to only those in your own system—an encoder/decoder setup does that. A telephone patch comes in handy for hams or in Business Radio; it's a fun thing or a status symbol for CBers.

Some accessories help you a lot, others only a little. From the basic information that follows, you can determine which accessories you need—on a basis of what you want to do with your station. With the right accessories, your two-way-radio dream station can become a reality.





Noise can be a serious problem with two-way radio. It cuts sensitivity as well as making many messages hard to understand. Some interfering noises, you receive *with* incoming radio signals. Others get into your base station through the *ac power lines.*

Most noticeable of radio noise on ac lines is that from motor-driven appliances. If you have your base at home, someone in the kitchen can bolix up your reception by using an electric knife, mixer, blender, or can opener. Suzie, your primping teenager, contributes radio noise from the bathroom with a hair dryer, hot comb, or electric shaver. Junior adds to this chaos from the workshop with his drill, saw, router, or rock tumbler. Maybe he's cleaning the family car; vacuums and buffers also add noise to radio signals. Your company base station receives noise interference from office machines and heavy electric machinery, and sometimes from appliances.

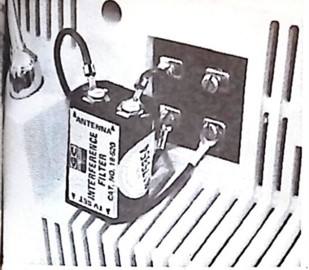
What can you do about it? Two things. You can reduce the interference generated by the offending apparatus. And/or you can suppress the effects of interference at your transceiver.

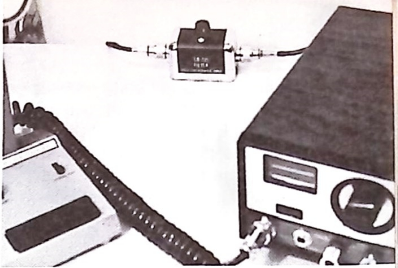
Several accessory manufacturers put out a device called an *appliance filter* or *power line filter.* It has two prongs and looks somewhat like an oversize ac plug. One of these inexpensive items could be installed anyplace in your home or office where interference-producing appliances are used. It takes one filter for each appliance and tool that's in use.

You cannot, of course, buy appliance filters for everyone in the neighborhood. Noise from their tools and appliances can travel along ac power lines and show up in your transceiver. Lower this possibility by installing a suppression filter at the ac outlet you plug your transceiver into. Like the appliance filter, you plug this one into the ac outlet, and your transceiver into the filter.

Filters may not screen out all ac noises and interference, but they do help when you need that little bit of extra quiet so you can pull out that weak, weak communication from a distant mobile.

NOTE: See also Chapter 8, for accessories that help with cutting down noise problems in mobiles.





Television interference (TVI) is the term used when your two-way radio signal shows up on someone's television set. TVI from CB radios can bother television channels 2 and 5, and now 6 since the new CB channels opened up. Ham and land mobile frequencies affect other TV channels, depending on the two-way radio frequency. It may show up on your own television. TVI causes the picture to have a herringbone pattern or wavy lines superimposed across the entire tube. The main clue that the interference is caused by two-way radio is the now-there-now-gone nature of the pattern. It stops when you stop transmitting. Your voice could sound in any channel, depending on how close you are and whether you're using more than the legal transmitter power. But technically that's not TVI—it's audio interference; you may hear it on hi-fi too.

Correct most TVI with filters. One type of TVI filter attaches to the TV antenna leads on the television set. Unplug the TV set before you start tinkering. Cut the television antenna wire about a foot from the set. Strip 1/2 inch of insulation from both antenna lead wires. Since TV antenna cable is *twin-lead,* you now have four bare wires. If the filter terminals are labeled, wrap the conductors from the antenna around the two filter terminals marked Antenna. Tighten the screws. Attach the cable from the TV to the other two filter terminals.

As with appliance filters, however, you can't go all over the neighborhood installing TVI filters. If the interference is the fault of your transceiver, you can cut down the interference there. Just add a transceiver-type TVI filter between your transceiver and your communications antenna. Make it a matter of routine when you set up your station. That'll keep everyone happier.

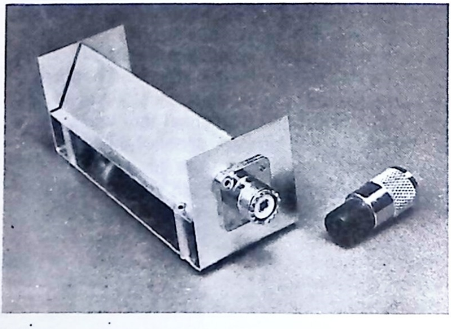
You'll need a coaxial jumper cable. Disconnect your two-way radio antenna from your transceiver. Connect the jumper in its place. If the filter terminals are labeled, connect the loose end of the jumper to the Transceiver end of the filter. Connect the antenna to the opposite end of the filter. Without labels, it doesn't matter which end you connect to what.

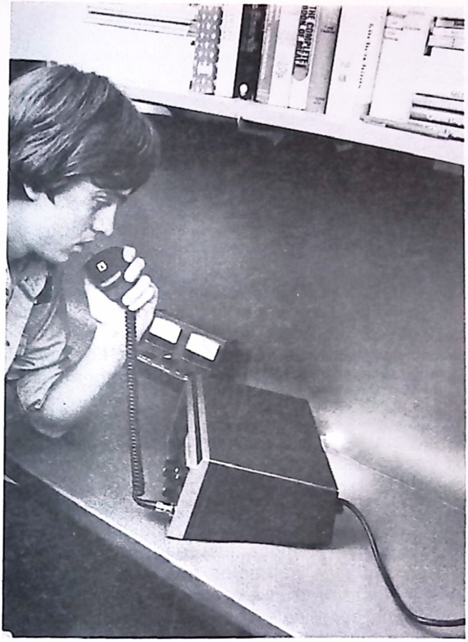
Since only other stations hear how well you transmit, you may get to suspecting your two-way radio isn't delivering signals properly. Even if you're sure, you can't know whether the trouble is with the transceiver or the antenna until you do some testing. You can detect faults with a vswr meter (as described on pages 96 and 97). If the vswr meter says the antenna looks okay, signified by a ratio of 1.5:1 or less, look for inefficiency in the transceiver.

Throwing an unmodulated carrier onto the airwaves is forbidden by the FCC, even during testing. Worse, it hampers operators trying to use the frequencies for communicating. Yet, to operate your transmitter without a load (which the antenna is) can damage transceiver components. So, you're faced with either an FCC violation or transceiver damage. The answer is to use an accessory called a *dummy load.*

Dummy loads come in various sizes. CB transmitters require a 5-watt dummy load. Others, with larger wattage ratings, handle more powerful two-way transceivers. The dummy load presents a perfect 52-ohm load, with a 1.1:1 vswr. Disconnect your antenna. Connect the dummy load to the antenna socket on the back of the transceiver. (You can use a dummy load with an in-line wattmeter too—see page 104.) With dummy load in place, you can safely key your transmitter for troubleshooting. The load absorbs the power instead of radiating it.

Ham radios operate with more power. A small dummy load won't work here. You need a dummy load that can handle 1000 watts of power output. Heavy-duty dummy loads are several times larger than 5-watt dummy loads and have cooling fins. With the bigger dummy loads, the "ideal" vswr changes with frequency or band. For transmitters operating up to 50 MHz, perfect vswr is 1.1:1—same as for CB. A 160-MHz transmitter gets by fine with a 1.3:1 standing-wave ratio in the load (be it dummy or antenna). A 220-MHz transmitter still works efficiently with a 1.7:1 standing-wave ratio.





Another kind of dummy load shows—in a rough way—the strength of your CB transmitter power output and modulation. It's called a *power light and modulation indicator.*

If you're not getting out, but your antenna vswr measures 1.2:1 or less, the trouble lies in either your transceiver or your mike.

Disconnect the antenna. In its stead, attach the power light. Key the transceiver. The light should glow brightly. If it doesn't, you likely have a faulty transmitter. (NOTE: do not test on upper or lower sideband; you'll blow the indicator lamp. The light can take up to 5 watts of power only. In the sideband modes, your power output can jump as high as 12 watts at times. Buy a new indicator.)

Key the rig again, and speak into the mike. Look at the light indicator as you talk. It should vary in brightness. If it doesn't, suspect your microphone as the weak link.

If a light-bulb indicator isn't scientific enough to suit you for measuring transmitter power output, you'll want an *in-line wattmeter.* Wattmeters, too, come in sizes, CBers use a 0-5 watt, 8-30 MHz wattmeter. Hams and Business Radio operators might use anything from a dual range 0-5/0-50 watt 144-163 MHz wattmeter to a 1000-watt wideband instrument. Fancier (and costly) wattmeters have interchangeable elements to accommodate a wide range of two-way-radio bands and frequencies, and various wattage scales.

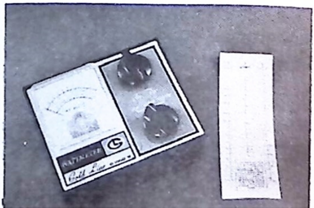
A wattmeter shows you in watts how much power leaves your transmitter and goes into the antenna system (the coax cable, first). In-line wattmeters attach between transceiver and antenna cable, with a coaxial jumper between meter and radio. Disconnect the antenna. Connect the 2-foot jumper coax to the transceiver and to the Transmitter side of the wattmeter. For transmitter measurements, screw a dummy load to the Antenna side of the wattmeter.

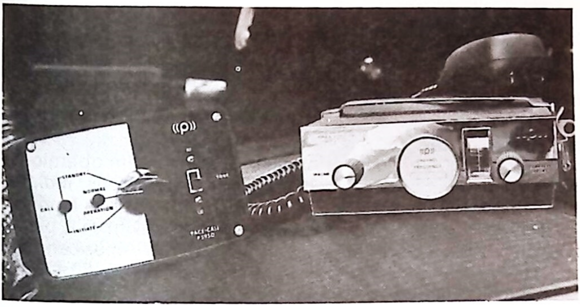
Set the watt-range knob or dial to the next range higher than your transceiver puts out. Key the transmitter. With CB, read the meter directly. If you're using a dual-range meter, multiply the reading—usually by 10 or 100. Transmitter power of 30 watts would put the needle at 3 on a 0-50 range. Some 10- to 1000-watt rf meters include scales marked for all ranges. You don't need to make computations with those; just read the meter.

You can't use an ordinary wattmeter for single-sideband power measurements. Ssb power is a complex quantity known as *peak envelope power,* abbreviated *pep.* Special instruments measure it, but they're too costly to be a likely accessory for you. However, remember this: Most ssb transceivers operate on a-m too. If a-m power is okay, your ssb output probably is, too.

You way choose to *leave* a wattmeter in the antenna line. In that event, unscrew the dummy load and attach the antenna cable. You can keep an eye on transceiver efficiency all the time, without cable manipulations.

You can get an *approximation* of antenna-system vswr (pages 96-97) with most in-line wattmeters. Just switch the instrument to measure *reflected* power. In terms of a power percentage, more than 10% reflected power suggests trouble. That's about a vswr of 2:1. Your dealer can probably get you a nomogram for converting any percentage ratio to vswr.





An accessory which you may want, but shouldn't try to install yourself, is an *encoder/decoder.* Basically, an encoder is a Business Radio accessory, although CB operators can use a similar tone-alerting system. Whatever the service, encoder setups are selective calling devices.

A business may have a dozen or so mobile units in the field. And for some reason, management may wish to carry on conversations more or less privately with each unit. With an encoder/decoder that's possible. The dispatcher can signal one unit without alerting the others (if all have decoders). In a busy metropolitan area, several companies may have to share a two-way-radio channel. A selective calling system keeps each from having to listen to messages from channel neighbors.

With a selective calling system, a small circuit board is inserted into each transceiver. Usually, it carries a tone-operated squelch control. The circuitry silences the receiver until an encoded call comes through. The unit originating the call sends out an encoding *tone* (usually subaudible) along with the regular communications signal. A decoder in the receiving transceiver recognizes the tone and opens the squelch. Without the tone, a signal from some other base, even on the same channel, leaves the set silent.

Several brands of selective calling devices are on the market. And features vary. Some decoders light up an indicator on the control panel when a message attempt has been made. That's for when the recipient operator is out of the mobile. Encoders/decoders are highly sophisticated two-way-radio accessories. They require special wiring of the mike and transceivers, and special technical adjustments. Any competent two-way-radio specialist can tailor a system to suit your individual needs.

One worthwhile accessory in any two-way radio base station is a *phone patch.* It allows you to "patch" a radio message directly to your telephone line, safely and without undue fuss.

In CB or BRS use, you would use the patch for communication between a mobile and an office or home that lacks two-way radio but has a telephone. In Amateur Radio, a ham operator in Sydney, Australia could contact a ham in Indianapolis, Indiana, USA, and be patched (at no charge) to an Indianapolis landline. (In fact, the Sydney ham could be relaying a call from a phone in Sydney via his own phone-patch setup.) The American ham places the local phone call. He tells the party to hold on for a radio patch from Sydney. The Aussie puts his party on the patch and so does the Yank. The two hams must monitor the conversation, and usually have to key their equipment for transmit. A *cradle* phone patch is voice-activated (vox), which saves the radio operator some work.

Here's how to connect one small CB phone patch—a *Gold Line* product.

(1) Assemble the tools and equipment you need—phone patch, screwdrivers, miniature phone plug, soldering iron, solder, transceiver schematic, single-edge razor blade, and black plastic tape.

(2) Unplug the transceiver from ac, and disconnect the antenna.

(3) Remove the transceiver chassis from its cabinet.

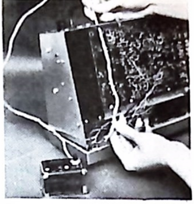
(4) Attached to the phone patch adapter is a cable with four wires—a red, a black, and a shielded white (which constitutes two conductors). The package also contains a small bundle of two-conductor wire.

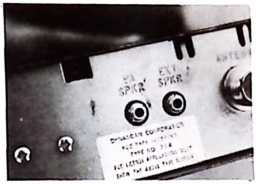
(5) Turn the patch adapter ON/OFF switch to OFF.

(6) Find a ventilation hole or slot on the back of the transceiver case. Drill only if you must. Run the four-wire cable through this hole. Pull in enough to reach the mike connector, plus an extra inch or two.

(7) Carefully slit a small hole in the outer insulation, just inside the chassis. Pull out the red and black wires, leaving the shielded white to reach the mike connector. Wrap tape around the cable here, inside the chassis, to prevent the insulation from splitting further and as strain relief for the cable.

(8) Either solder red and black to the receiver speaker terminals or to a miniature phone plug. If the latter, plug into the *Auxiliary* speaker jack and NOT into PA. You could, if you're familiar with how speaker jacks are wired, make the red and black connections right at the jack, inside the chassis.





(9) With schematic in hand, identify the mike connector terminals.

(10) Pull 1/2 inch of the braided shield away from the white wire. Twist the shield and solder it to a chassis ground on or near the mike connector.

(11) Strip 5/16 inch of insulation from the end of the white wire. Connect this wire to the mike connector "hot" terminal.

(12) Put the transceiver back into its cabinet.

(13) To make the phone-line connection, remove the cover plate of the telephone terminal nearest your transceiver.

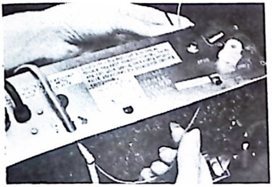
(14) Separate the wires of the two-wire cable for a couple of inches. Strip 5/16 inch of insulation off the end of each wire, and melt a little solder onto them.

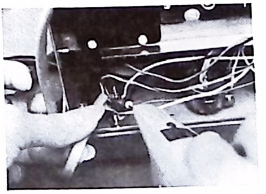
(15) Loosen the screws holding the red and green wires in the telephone terminal.

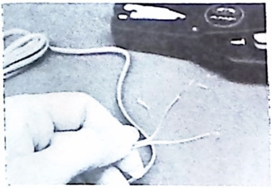
(16) Connect one wire of the pair to the red terminal, and the other to the green. Tighten the screws. *AVOID* contact with a yellow or black wire in the telephone terminal. Replace the cover plate.

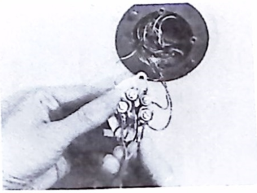
(17) Connect the other end of the pair to the Phone terminals on the patch adapter. Use extra two-wire cable if you need it.

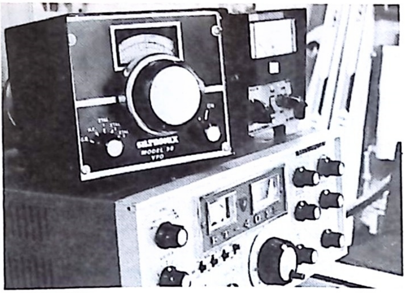
(18) Connect your transceiver to power and attach the antenna. Try the patch, first chance you have. Once you get the volume levels adjusted, you'll enjoy using it.











You've probably heard of "sliders" and "whiskey radio." Bootleg CB—the illegal use of unauthorized frequencies—is an unsavory side of CB radio. No CB bootlegger uses legitimate call letters; they use self-glorifying handles like Whiskey Sam, Kickpoo Joy Juice Kid, Greased Lightning, White Lightning, Redeye, or Buttermilk Bootlegger. A few insecure individuals in every crowd distort useful privileges into something illegal. They don't care—most don't know enough about two-way radio even to realize—how much interference they cause to other communications and navigation services.

The accessory involved here is the "slider," properly named *variable frequency oscillator* (vfo). A variable frequency oscillator in ham bands is a legitimate and useful tool. It allows the ham radio operator continuous channel tuning. But it's illegal with CB transceivers. A CB channel selector switches from channel to channel; each channel is pre-tuned, by crystal control, to an exact frequency. But when two operators with vfo's "slide" onto other frequencies, they can't even tell what *part* of the spectrum they're fouling up, let alone tune to a proper frequency within the illegal spectrum.

The VFO label you see on a few expensive CB transceivers is legal. It tunes only a little bit on each side of the channel frequencies. If a signal seems a bit off-frequency, the CBer with this knob can zero in on the exact frequency. For single-sideband, this clarifies the recovered speech. In less expensive sets, a similar control goes by the name *Delta Tune.*

Perhaps the most infamous accessory in two-way radio is the *linear amplifier.* A linear amplifier (linear) is intended for use in Amateur Radio systems. It greatly boosts rf output, particularly for single-sideband transmission. A ham transceiver that puts out 10 to 25 watts can be thus boosted to deliver a full kilowatt of rf output.

Like many transmitter accessories, linears hook in between the radio and the antenna. You need the ubiquitous coaxial jumper, but it can be longer than the common 2-foot size if need be. Mobile linears attach directly to the battery for operating voltage. Base station linears operate off regular ac household voltage.

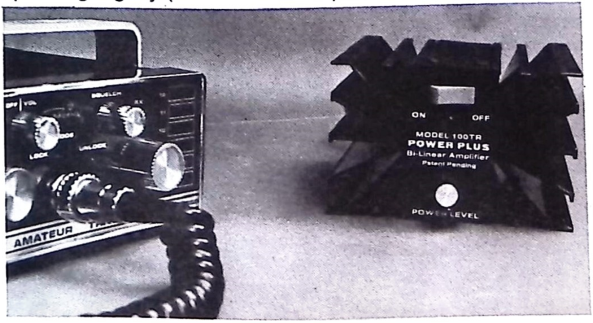
Watch several things when installing a linear: (1) Give it plenty of breathing room. In developing all that power, the amplifier heats up. Cooling fins help combat the temperature. Intelligent placement usually does the rest.

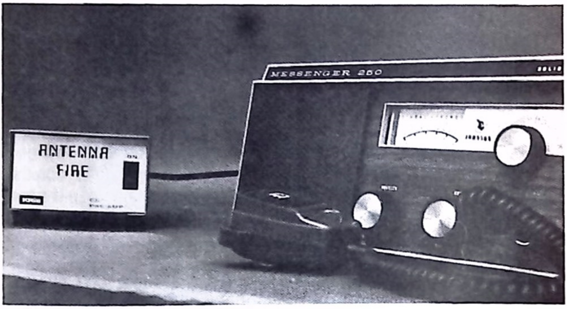
(2) Check the vswr. Hooking a linear up to a poorly tuned antenna can result in damage to both linear and antenna.

(3) Be sure the antenna can withstand the full power your linear amp can deliver. Many, especially mobile designs, cannot take so much; loading coils burn out.

Linear amplifiers are legal for hams and for some uses in Business and Industrial Radio. But FCC Rules say it's illegal for a CBer to buy, use, own, install, or even store a linear amplifier on the premises. When you're caught, penalties are stiff—and it's one violation FCC inspectors particularly look for these days.

Class D Citizens Band radio is limited to 4-watts rf power output in the a-m mode. A linear amplifier attached to a CB transceiver boosts that to much higher, from 40 or 60 watts to 100 or more. THIS IS NOT LEGAL. This excess power squashes legal transmissions by other CBers. Usually, because the user doesn't know enough to adjust the linear amplifier properly, his ratchet-jaw antics blanket not just one channel, but many adjacent channels. Such abuse of CB channels is grossly unfair to those operating legally (not that he cares).





One signal-boosting accessory is legal for CB. It's a *preamplifier.* A preamp hooks into your antenna system at the back of the transceiver. It gets operating voltage from the car battery or house ac. A preamp does not affect rf *output.* What it does is amplify signals received. By boosting weaker, incoming signals, the preamp lets you carry on reliable conversation with an operator who lives (or whose mobile is sitting) much farther away than you could normally hear him. However, if he lacks a preamp, he may not hear you as well as you hear him.

Also be aware that while it boosts the wanted incoming signal, a preamp strengthens others too, and brings some unwanted noise up loud enough to annoy.

Some pre-amps switch off automatically when you press the mike button, and back on when you release it. Others require manual switching. Consider that when you shop for a preamp.

Ham operators can use what's called a *bi-linear* amplifier. (It's not legal for Class D CBers.) A bi-linear gives a healthy boost to both outgoing and incoming signals. Unlike with preamps, the guy on the other end most likely will hear you as well as you hear him. When more distance seems necessary for your communications, and you can't raise the antenna any higher, a bi-linear helps some.

CHAPTER 7

Dressing Up Your Mobile Radio

What do you consider a mobile radio? One in a truck or car? You're right. But a mobile radio can also be in a boat, an airplane, a bus, motorcycle, or recreational vehicle. Since space in some of these vehicles is limited, transceiver accessories are necessarily smaller. However, you'll want to consider certain mobile accessories. Like base station accessories, they make your two-way mobile radio more efficient and convenient.

This chapter not only shows items to dress up a mobile unit, it also covers devices that make owning and operating a two-way radio more convenient. There's not room here for all mobile accessories. Some prior chapters deal with their base station counterparts. Earlier pages on microphones, speakers, and cables, for example, apply to mobiles as well as fixed (base) stations. This chapter is uniquely mobile. You'll likely find a use in your two-way radio system for everything discussed here.

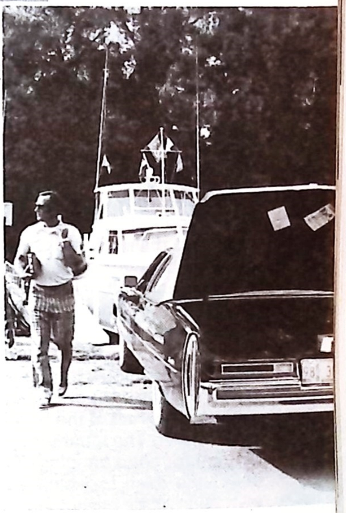
Every car should have a first aid kit. So should, in a manner of speaking, your two-way mobile radio. A lot can happen to a mobile unit: Fuses blow. The transceiver slides or drops out of its bracket. Wires snap. Connectors work loose and fall off.

I know, for example, of a lady who, anxious to be on the road, hurriedly packed her car for a week-long trip. Just before pulling away, she connected her CB transceiver. (A careful CBer never leaves her radio in the car.) She plugged the voltage connection into the car's fuse block, tightened the radio in its bracket, and turned it on. It lit up for a few seconds, and then went dead.

She checked the connection at the fuse block. It was okay. The ground was okay too. It must be a fuse, she thought. Fortunately, she had with her a kit of replacement items. *Littlefuse* makes a CB Radio/Auto Stereo Installation Kit that suits emergencies like this.

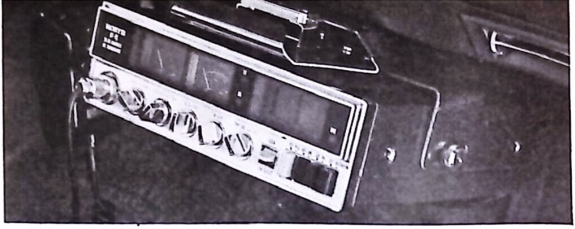
She put in a new fuse and turned on the radio. It lit up again for a few seconds, then nothing. Before our CB lady found the fault, a bare spot where some black tape had slipped, she had replaced two more blown fuses. The cure was a new power-connector cable with quick-disconnect in it. She had that in her installation kit too.

Had she not been in a hurry, had she not been careless, had she seen the bare spot at once, she would have saved time and needed fewer spare parts. But not many two-way radio operators qualify as technicians. Being observant, once she slowed down, this lady got lucky. Even luckier, she had with her a "first aid kit" and a few tools to work on her two-way installation. Because she was prepared, she enjoyed the use of her CB during the journey.



Many mobile accessories nowadays have to do with getting a two-way transceiver out of the car easily, or with disguising the antenna. That's with good reason. The number of two-way radio thefts has grown astounding. In some localities, half of all CB radios sold are stolen. The problem has become so great, solutions had to be found.

A thief can gain access to almost any car in less than 60 seconds. A two-way radio antenna on your vehicle quickly identifies it as having valuable property aboard that is generally easily resold—especially if it's CB radio. So, in almost any two-way-radio store, you'll find an array of quick connectors for power leads, theft-thwarting mounting brackets, burglar alarms, quick antenna cable connectors, and disguise antennas. Most of these accessories are easy to install. There's no need for you to become a radio theft victim.



To remove the transceiver quickly for safe storage, consider a *slide-in mounting bracket*. In some vehicles, the bracket fits under the dash; in others, the side of the console proves more convenient.

A typical slide-mount bracket has two parts. One half attaches to the vehicle, the other half to the transceiver. Sometimes the top bracket may have a terminal for a PL-259 antenna connector, so you can leave the antenna connected. One set of contacts then makes the antenna connection to the radio.

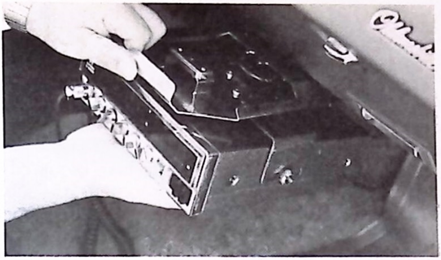
Here's how you go about installing a slide-mount. Start with the top bracket. It has two wires, red and black. Both are usually short. So go to the transceiver power leads. Cut them about 4 inches beyond the fuse, leaving the fuse with the transceiver. That gives you a leftover stretch of black and red wire. Splice these to their mates on the top bracket. Use either foldover wire splicers (page 116) or butt-type crimp splicers (page 118).

Mount this half of the bracket in the vehicle, within easy reach of the driver. The mount may have several holes. You need three of them for solid hanging. Try to find at least two existing holes under the dash to which you can fasten the bracket. The ash tray slide may have them. Where you can't match up three holes, use a supplemental brace.

If you have to drill, use caution; air conditioning ducts run along the lower dash edge in many vehicles. Use only a three-prong grounded drill, plugged into a ground outlet. A bushing or drill stop placed over the bit prevents it from punching through the dash too far.

Stick masking or duct tape over the spot to be drilled. Arrange the bracket, and mark the hole(s) on the tape. Centerpunch each mark, and drill the holes. (Tape and centerpunching prevents scars on the dash.) Remove the tape. Mount the bracket with self-tapping screws.

Page 117 shows how to connect the red and black voltage leads. Secure the black wire to ground first. Then plug the red wire into the vehicle's fuse block. If the top half of your slide mount bracket has an antenna socket, attach the PL-259 antenna cable connector there.



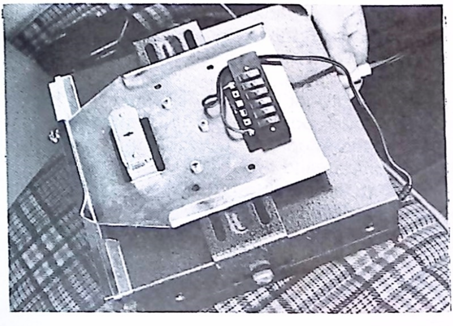
You can sometimes buy this top half of the slide-mount individually—one for each car. You may want to switch your transceiver from your car to a boat or recreational vehicle. Using one radio saves money (even if you buy whole mounts and use only half).

Mount the bottom half of the slide-mount to the transceiver hanger bracket, *before* you add the transceiver. Slots in the transceiver bracket usually match up to holes in the slide-mount. Use at least three bolts, washers, lockwashers, and nuts, four if holes are provided. Turn the side with the contacts so it faces upward. Push each bolt through the slide-mount slot first, and then through the transceiver bracket. That leaves the bolt head on top of the slide bracket.

Attach the bracket to the transceiver. Tighten all nuts securely.

You have some wires to connect. Splice the red and black wires of the bracket to those from the transceiver (the ones you trimmed shorter). Connect the short coaxial lead to the antenna socket on the transceiver. If the bracket doesn't have this feature, connect the antenna directly to the transceiver.

Slide the transceiver, with bracket attached, into the part mounted in the vehicle. Turn on the transceiver, check the vswr (pages 96-97), and communicate.



Without a slide-mount bracket, you've got to disconnect voltage leads to take the transceiver out of the vehicle. Do it fast with *quick-disconnects*. Several manufacturers make them, some more elaborate than others. You see the *Har-Cor* brand here, and the *Har-Cor* Adapta-Clip fuse-block connector.

To add this quick-disconnector to your transceiver leads, you need only wire cutters and pliers—no special tools. In the quick-disconnector package you find the two-part connector and four fold-over wire splicers. Two wires—one red, one black—lead into each part of the connector. These mate with your transceiver power leads. Alawys match colors, red to red and black to black.

Cut the transceiver wires, about a foot from the transceiver. If there's a fuse holder, leave it with the transceiver. If the leads are one cord, separate the conductors for 3 to 4 inches to give yourself working room.

Pick up one of the wire splicers. Lay the black lead from the transceiver in one slot of the splicer. Notice the metal tab in the center of the splicer. Don't push or disturb that yet.

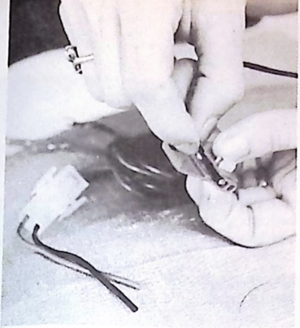
One half of the connector has squeeze tabs on the side, to "unlock" the connector so you can pull the two halves apart. Insert a black wire from this half of the connector into the other slot of the splicer.

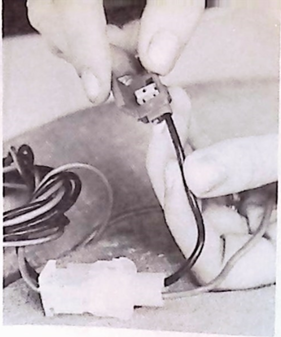
Squeeze the metal tab with pliers. It's actually a plunger. It penetrates the insulation of both wires, to make the electrical connection, and anchors them in the splicer. Fold the plastic cover over the metal tab. Snap the cover shut. Now repeat all this for the red wire from the transceiver.

Pick up the lengths of red and black wire you earlier cut off the transceiver leads. Splice the cut ends to the red and black wires on the other half of the quick-disconnector, using the remaining two fold-over splicers.

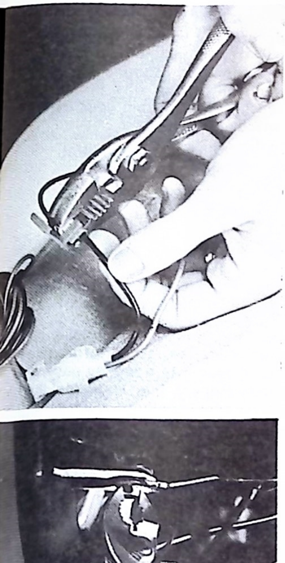
Leave the quick-disconnector plugged together while you make the connections for voltage and ground. First prepare the black wire (ground). Crimp on a spade lug. Find a screw or bolt, under the dash, that connects tightly into metal. Loosen it. Slip the lug under the head of the screw. Tighten. That's the ground for the negative side of the voltage.

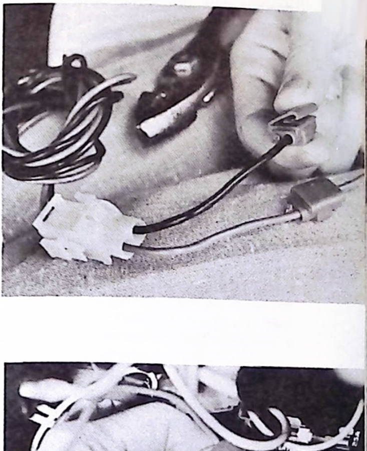
That leaves only the red or "hot" lead. It connects to a positive voltage source. The most accessible point usually is the fuse block. Here's where the Adapta-Clip comes into use. Strip 3/8 inch of insulation from the end of the red wire. Crimp on a slip-on terminal lug from the Adapta-Clip package. Slip an Adapta-Clip into this solderless terminal lug. Finally, slide the

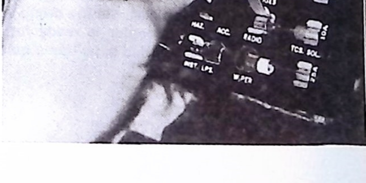




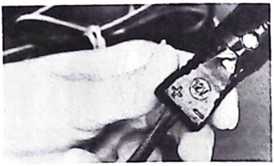
curved end of the clip down into a fuse clip at the end of your radio fuse, or any unused fuse. Connect to the end nearest the center of the fuse block.



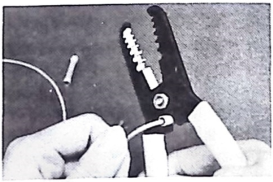




If your car or truck has a cigarette lighter plug, it makes a voltage source that's quick to disconnect from. You need a *cigarette lighter plug adapter*, and two wire splicers. No need to cut your power leads here, except to trim the ends for crimping.

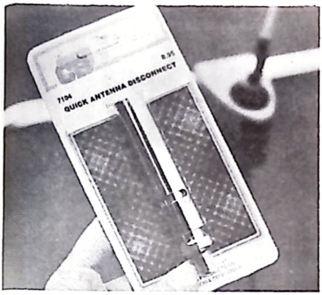


On many plug adapters you have only black zipcord. But you can identify the positive wire two ways. One, the plus (positive) and minus (negative or ground) are usually embossed on the plug. If they're not, examine the cord itself. Insulation on the positive wire is grooved; the ground wire insulation is smooth. The positive or grooved wire mates with the red from your transceiver. Smooth mates with transceiver black.

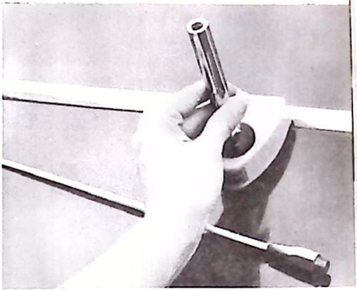


Separate the plug-cable wires for 3 or 4 inches. Strip ⅜ inch of insulation off the ends. Do the same for both transceiver wires. Slide the red wire from the transceiver and the grooved wire from the adapter plug into opposite ends of a crimp-on butt splicer. Crimp onto both wires. Repeat this to splice the smooth wire and the black transceiver wire together.

To make sure you have set the crimp securely, tug on the wires. If they hold, your lighter-plug adapter is ready for use. These don't fit lighters in some imported cars. Use a quick-disconnect for those.



Hiding your two-way radio antenna also deters thievery to some extent. An inexpensive *antenna quick disconnect* works on some mobile antenna types. It lets you put the antenna rod in the trunk with your transceiver when you leave the car. The whole setup is easy enough to install. The antenna itself has two parts which spring-lock together. Notice the notch and pin.



Start by unscrewing the antenna rod from its base bracket. Screw the antenna quick disconnect into the bracket in place of the rod. The antenna rod now goes on the disconnect barrel. You'll have to retune the antenna, or have your technician do it.

Thereafter, when you're going to be away from your vehicle, push the top half of the quick-disconnector down. This releases the pin from the notch. Twist the top of the disconnector so the pin falls into the release channel. Lift off the antenna rod and top portion of the quick-disconnect. Stow them in the trunk, out of sight.

Now that you've gone through the basic methods of quick-removal mobile installations, how about some refinements? Suppose you don't like, or can't fit in, a slide-mount bracket for your transceiver. There are plenty of other methods. One caution: Ascertain that any mounting bracket you select is strong enough to hold your transceiver. Some ham and business radios are pretty hefty.

One possibility worth considering is called a *universal hump mount*. It's adjustable in two directions: to fit the width and shape of the transmission hump, and to set the attitude of the transceiver so you can see the panel clearly and without reflections. Temporarily attach the transceiver mounting hanger to the hump mount. Loosen the screws that lock the top platform to the mount. Slide the transceiver into its hanger, but don't bother fastening it yet. Raise the front of the mounting platform until the transceiver faces you at an easy-to-reach angle. Hold the mount steady and tighten the locking screws. Lift off the transceiver.

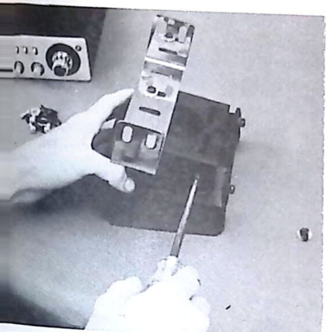
Arrange the transceiver hanger bracket on the hump mount, matching two slots. Slide a washer onto each of two bolts. Push the bolts through the slots. Put a flat washer and a lockwasher on the bolt, at the underside of the hump mount. Screw a nut fingertight onto the bolt. With pliers or wrench and screwdriver, tighten the bolts.

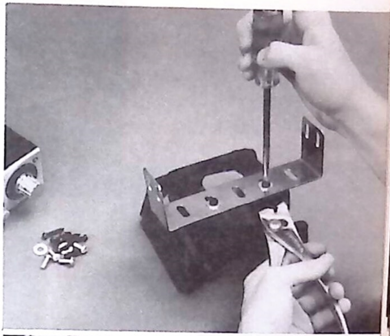
Take the assembly to your car. Set it on the hump, as far forward under the dash as is practical. Be sure it leaves room for the transceiver. Adjust the wing flaps of the mount so they lie solidly on each side of the transmission ridge.

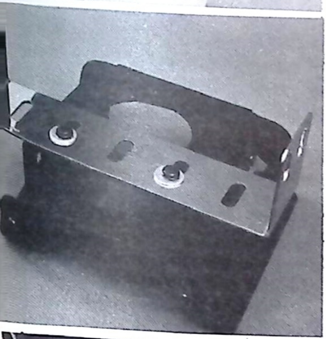
Use the self-tapping screws from the hump-mount kit to secure the bracket to the vehicle floor. Don't fasten just into the rug. Those screws need to bite into solid floor metal. If you need to, use a drill to make starter holes for the screws. Screw the mount down tightly to the hump. Don't drill into the transmission cover.

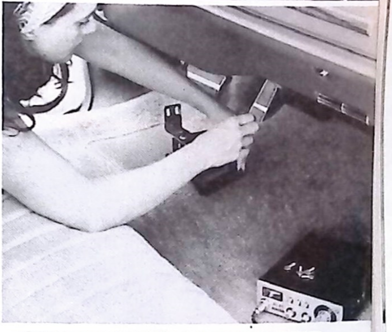
Finally, put the transceiver in the hanger bracket. Secure it with thumb-bolts instead of those that come with it. Provide washers to assure a sturdy mounting.

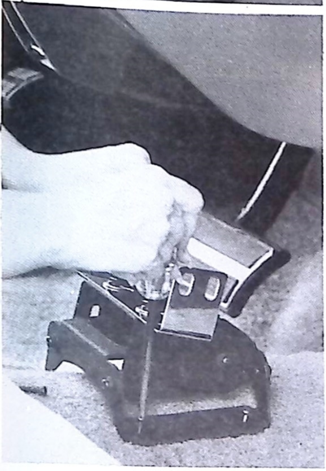
If this mounting hides the transceiver speaker enough to muffle its sound, install an external one (Chapter 3) and plug into the Auxiliary Speaker jack.

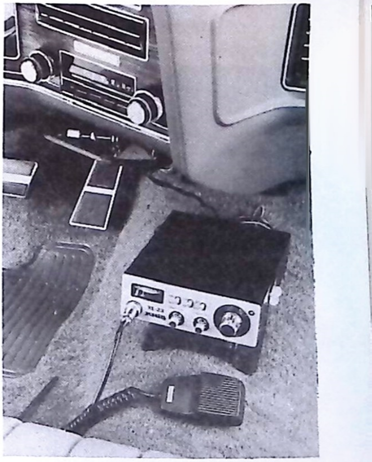


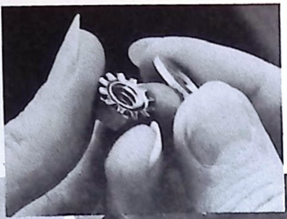


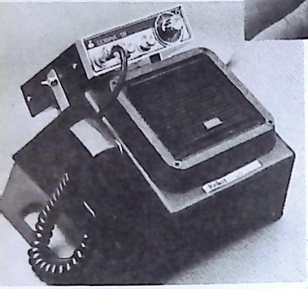


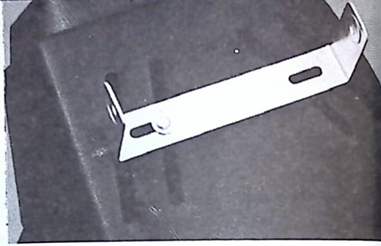


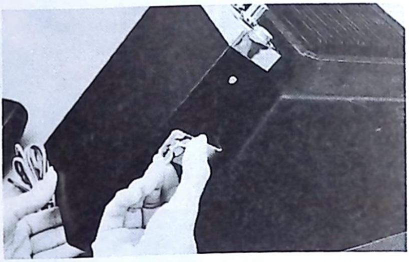


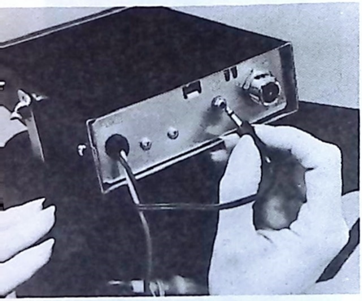


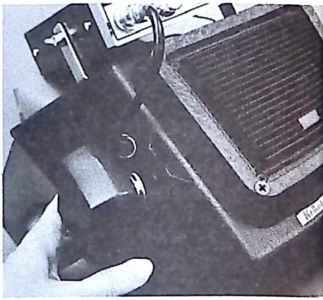












If you're hunting seriously for transceiver mounting convenience, take a look at the *Kriket* Kamel. It's a combination transceiver mount, mike bracket, and auxiliary speaker—all rolled into one package that rests right on the drive hump. Attach a lighter-plug adapter for voltage; use a PL-259 slip-on connector for the antenna cable; and you have an exceptionally compact, easy to disconnect, clear-sounding mounting setup. For installation all you need are screwdriver and pliers.

Turn the Kamel cabinet around. On the back you'll see four slots near the top. These slots are angled to facilitate mounting almost any size transceiver. Mounting hardware consists of two bolts and two washers and two serrated-edge locknuts. If these don't fit your transceiver hanger, buy sizes that do. As with the universal hump mount, push the bolts through washers from the top of the transceiver bracket. Thread the special nuts onto the bolts from the underside of the Kamel cabinet.

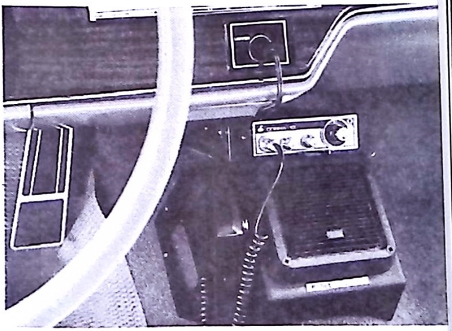
Fit the transceiver into its mounting bracket. Tighten the wing bolts. If your transceiver has plain bolts, they're okay to use; the Kamel lifts out intact for quick removal.

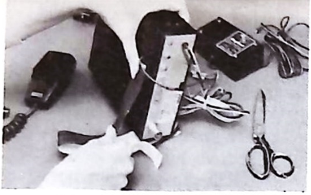
Fish up the Kamel speaker wire from under the cabinet. Bring it through one of the unused mounting slots. Plug the speaker into the External Speaker jack on the rear of the transceiver. (Be sure it's not into PA.)

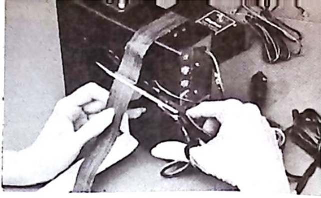
Connect the microphone. Hang it in the mike bracket already in place on the side of the Kamel cabinet.

To hook up this unit, just set it on the transmission hump in your car, plug in voltage, slip on the antenna cable. This takes about 15 seconds. To disconnect and take out, just unplug voltage and antenna. Pick up the whole outfit and store it in the trunk or carry it into the house or motel.

In the car or truck, use one of the fast-out hookups described on pages 116-118, and the slip-on PL-259 shown on page 67. Once indoors, connect it to a 12-volt power supply, add some kind of antenna, and you have a nifty-sounding, compact base station.







You may feel that all quick-disconnect entails just too much hassle. You could try an alarm system. The best alarms are costly and need professional installation. Many cheap alarm gadgets are a waste of money.

One alarm system that seems to work well without being costly consists of a 9-volt battery, special tape, and a control box. Once this alarm is armed, anyone merely touching the transceiver sets off the warning. It sounds for an hour or more if you don't turn it off. This alarm works best with dash-mounted transceivers.

This alarm system is the *Magitran* Touch-Sensitive Anti-Theft Alarm. To install it you unscrew the back panel of the control box and insert the 9-volt battery (change it every few months). Find someplace to hide the control box—under the seat or behind the dash, but not anyplace that would muffle the alarm sounder. Put it somewhere that you'll remember to arm it when you leave the vehicle, and disarm it when you return.

The wired tape wraps around your transceiver. Place the tape about an inch behind the front panel of a transceiver mounted under the dash. For an in-dash transceiver, wrap the tape about an inch from the back. You want the tape far enough from the mounting bracket or any other metal that it can't accidentally become grounded.

Start with the wired end of the tape. Remove the backing that protects the adhesive. Press the tape to the transceiver. Cut off any excess with scissors.

There's a ring lug on one of the wires emanating from the control box. Ground that. At this stage, make sure the control box switch is OFF. Connect the terminal lug on the tape wire to the terminal on the alarm control box.

To regulate sensitivity of the alarm, turn the sensitivity knob completely counterclockwise. Switch the alarm ON. Turn the knob clockwise until the alarm sounds. Switch the alarm control OFF. If the alarm still sounds, turn the sensitivity knob slowly counterclockwise until the warning stops.

Switch the control box back ON. Touch the transceiver. The alarm should sound loud and clear. Turn the alarm off until you're ready to use it. Hide the control box.

Mike hangers become accessories when the one that came with your new transceiver won't fit your installation. You also buy another when your old one gets bent or lost.

The old screw-on–type hanger you can attach to the transceiver. If you prefer having your mike nearer, drill holes. But give the matter some cautious thought; drilling disfigures the dash. Also watch out for air conditioning ducts. Use a drill-stop so the bit can't go any deeper than it must. Always centerpunch before you drill. And, for good measure, cover the drilling spots with duct tape.

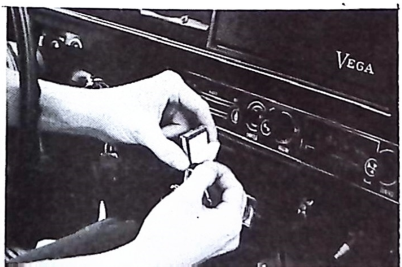
But let's say you don't want to drill holes. If you have a metal dash, slap a magnetic mike holder on a convenient hanging spot. The only metal on the dash of some cars is the ash tray. In most modern cars—and trucks—"sculptured" design leaves too many curves that a magnetic mount couldn't cling to anyway.

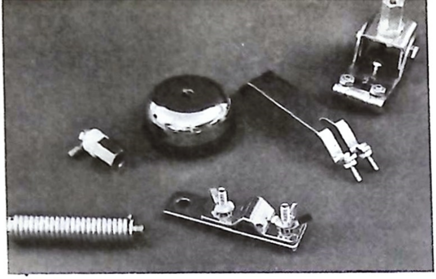
What then? Useful alternatives are adhesive and Velcro mounting. With the adhesive type, you just peel off the backing and stick the mike holder wherever you want to hang it.

A Velcro hanger goes anywhere. There are two parts, both with adhesive on the back. Decide on your mounting location. Pull the Velcro hanger apart. Remove the protective backing from the adhesive of one piece. Press it firmly on the spot.

The remaining piece goes on the mike. The material, being square or rectangular, won't fit the mike hook or knob exactly. So, with scissors, cut the Velcro to fit. Then remove the adhesive backing, and stick the Velcro onto the mike hangup button.

Touch the two pieces of Velcro together. They'll cling, and you've hung the mike. Try not to catch the Velcro on knit clothing; it causes snags.





Antennas are themselves two-way-radio accessories. Certain antenna parts also qualify as accessories. Communications antennas are vulnerable—to car washes, to trees and brush, to garage doors, to vandalism, to almost everything. Brackets get bent. Antenna rods warp. A spring sags. These parts are available, allowing you to replace only damaged pieces instead of buying a whole new antenna.

One minor antenna accessory is a *hold-down clip.* It grips the end of your 102-inch whip when your two-way radio is not in service. Don't fasten the whip down, however, if you expect to use the transceiver. You could damage the radio. Use the clip also when parking your vehicle in a garage or carport.

A hold-down clip may be made of metal or plastic. It ordinarily screws to the rain-gutter of your vehicle. One type *clamps* onto the antenna. Another has a slot resembling a keyhole; you push the antenna tip through the round portion of the hole, then slide it up into the slot. Position any clip so a little of the antenna extends through the clip, making it difficult for the antenna to flip loose.

It's advisable to remove your antenna rod when taking your car through a wash. But, that bares the electric contacts inside the mount. Worse, water in the base brings on rust and corrosion. Protect this open end with a plastic *protector cap.* It fits over the threads on the mounting bracket. Some antennas have a cap like this on the base when you buy it. Save it. Use the protector cap also when you're stowing the antenna rod. The antenna will last longer and perform better.

You may get the idea that two antennas work better than one. However, for two antennas to work together requires special consideration called *co-phasing.* Co-phased dual antennas come with a special coaxial cable harness. Impedances between the two antennas must be mated exactly to deliver the best possible performance (and lowest vswr).

You don't have a co-phased harness when you buy two separate antennas at two different times. Nor is it easy to make one. However, you can arrange co-phasing between these two antennas with a *co-phase antenna matcher.* You'll need a vswr meter, two 2-foot coaxial jumper cables, a 12-foot coax cable, and the matcher. Plus, of course, your antennas.

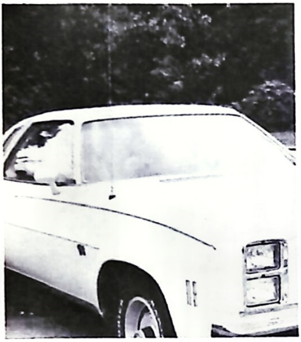
Mount your antennas as far apart on the vehicle as possible—108 inches would be near perfect.

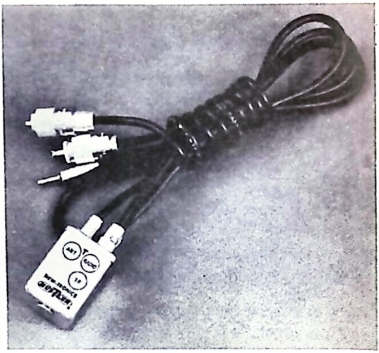
First, you tune each antenna separately. Attach a 2-foot jumper cable between the transceiver and the vswr meter. Connect the 12-foot cable from the vswr meter to one antenna. Measure vswr (pages 96-97). Tune the antenna as necessary to obtain the lowest possible vswr reading. Connect the 12-foot cable to the second antenna. Read the vswr. Tune if necessary.

Disconnect the 12-foot coax from the vswr meter and from the second antenna. Connect the regular cables to each antenna. Plug those cables into the co-phase matcher. Attach the second 2-foot jumper cable to the vswr meter. Screw the other end of the jumper onto the Transmitter terminal on the matcher.

This *Gold Line* co-phaser has two knobs and works just like base station antenna matchers. Don't try to reach the ideal vswr reading on the first go. Key the transmitter and note vswr. Tune the knob for the first antenna to reduce the vswr slightly. Tune the knob for the other antenna to further reduce the vswr. Continue back and forth until you reach the minimum possible vswr.

Remove the vswr meter, but leave the co-phase antenna matcher connected.





You no doubt realize that communications antennas are the waving flag that marks two-way-equipped vehicles for thieves. However, with a *disguise antenna* or an *antenna adapter,* your radio-equipped vehicle need never be noticed, in a crowded parking lot or standing alone.

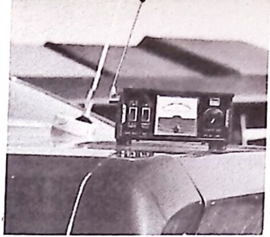
Take a disguise antenna for example. Some recent models—such as the *Antenna Specialists* MR-264 on the Malibu above—are also an AM/FM antenna. Mounting on the cowl of your vehicle is an advantage. Since radio antennas traditionally mount on the cowl, no one notices.

Unless you have the time and expertise, let a radio technician install the disguise antenna for you. He can do it faster and better than you can. Moreover, if it needs to be tuned, he can adjust it for peak performance.

Several antenna converters or adapters are on the accessory market these days. Some work, some don't. Theoretically, they match your ordinary radio antenna to a CB transceiver. The most effective of these devices do just the converse; they adapt a CB antenna to deliver AM/FM radio signals.

Pictured below is a *New-Tronics* Hustler device called merely a *matching harness.* It permits AM/FM radio reception from any *ungrounded* CB antenna. There are three connectors. The two PL-259 connectors attach to the CB antenna and to the transceiver. The third plug (a Motorola pin-type) goes into the antenna hole on the rear of your AM/FM radio. Once the coupler is installed, test vswr at the transceiver. Retune the antenna, if necessary.

If reception turns poor with any of these antenna systems, drive to a licensed technician. The converter or antenna may require adjustments beyond your abilities and know-how.



After you've done all that accessorizing and perhaps experimenting with mobile antennas, you come back to that age-old question all two-way radio operators ask: "How am I getting out?" (meaning: am I, how strong, and how far?). If your transceiver lacks a power meter, a *field-strength meter* offers some answers.

You can buy a field strength meter alone. You may find it part of certain vswr meters. Any vswr meter with a small antenna (sensor wire) is also a field-strength meter.

Set the field-strength meter a few feet away from your mobile antenna. Position the mini antenna or sensor wire on the field strength meter so it runs parallel with the antenna radiator or rod.

Key the transceiver. If you don't see much of a reading, move the meter closer to the antenna. If you can't get a reading, with the meter 2 feet from the antenna, your system is not reaching out. Look for a faulty antenna connector, or a crimp along the cable. The transmitter could need attention.

If the meter reading goes clear off-scale on the first try, your system must be radiating plenty of energy. Move the meter farther away from the antenna. Transmit again. Place the meter where you get a reading almost full scale.

While you're measuring field strength, keep your hands and body well away from the sensor wire. Even an animal nearby can cause fluctuations in the meter reading. Wind shaking the antenna or the sensor wire causes varying and unreliable readings.

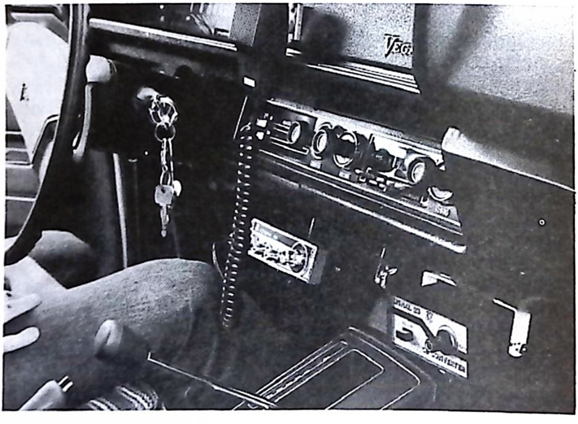
When your installation is new, you can measure and note the distance from antenna to sensor wire when you get a stable reading. You thereafter keep an eye on performance. Every month or so, recheck your system's field strength, at the same distance. If the meter registers the same strength, everything's still doing okay. However, if the meter reads less than before, performance is dropping. Examine your antenna tuning. Have a technician test vswr and power output, or check them yourself if you have the vswr meter and wattmeter. If none of these help you locate the problem, see your licensed, qualified technician.

Lots of CB dealers do not consider a *CB converter* a valid two-way radio accessory. But it is. If you have business radio or an amateur transceiver in your mobile, that probably handles your personal communications needs. But let's say that, along with all this, you're on the road a lot. You could listen to those famous highway and Smokey reports with a CB converter.

You need no special antenna. A CB converter wires into any AM or FM radio. Here's what you do.

Mount the CB converter bracket just as you would for a transceiver. Then locate and unplug the antenna cable that plugs into the back of your car radio. Plug this antenna cable into the receptacle on the CB converter. Insert the cable plug from the converter into the radio antenna jack on the back of the car radio. Splice the voltage wire into a 12-volt positive lead somewhere, or crimp on a lug and connect to the fuse block, as you would a transceiver positive wire.

When you want to monitor CB, push the converter's switch ON. Find channel 19 by using the tuning knob of your AM radio.



CHAPTER 8

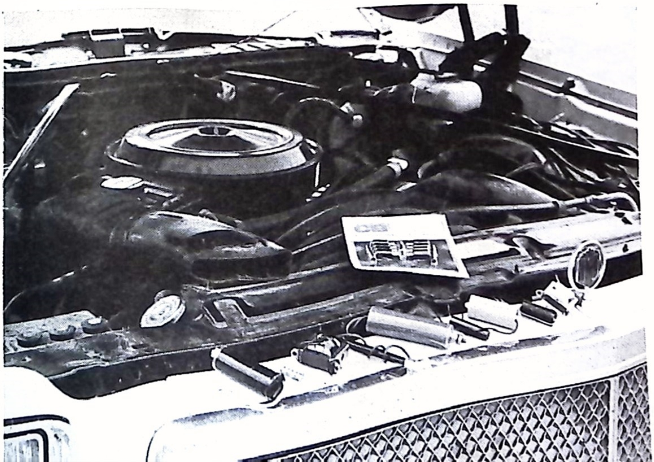
Combating Mobile Noise With Filters

One more category of accessories helps pave the way to better mobile communications. They improve reception by suppressing and filtering rf (radio frequency) noise that interferes with incoming signals. Try this experiment.

With engine off, switch your transceiver on. Open the squelch. Listen for a few minutes. You'll probably hear quite a few clear messages, without much accompanying noise. If you have ANL (automatic noise limiter) or NB (noise blanker), switch it on and off. You'll notice little, if any, change in transceiver performance.

Now start your engine. Let it idle. Hear the popping and frying noises that were absent before? You can't wipe out all of that, but you can suppress it. ANL or noise blanking circuits helps chop some of it out; try their switches and see. But the best suppression techniques go to the *cause.*

Automotive noise interference often gets worse when your engine needs a tune-up. Put that in top condition first. Then apply this chapter. It helps you identify noise problems, and shows how to remedy them.



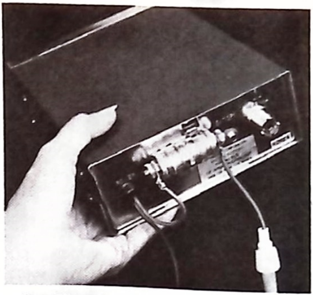
Diagnosing noises that interfere with two-way radio reception can be a real witch hunt. Yet today, it needn't be (although one noise-hunting device resembles a witching rod).

Other than hiring an experienced CB technician, perhaps your easiest method of diagnosing interference problems lies with the *GC Electronics* CB Trouble Tape. It's a cassette recording. On part of the tape you hear noise interference that occurs in base stations. Another part discusses, describes, and lets you hear noises that interfere with mobile reception.

Take your cassette player and the Trouble Tape out to your mobile. Set your transceiver to a channel with someone talking on it, but not nearby. Keep transceiver volume low. Start the tape. It deals with one type of noise at a time, describing how and why. Then you hear an audible example. The tape then suggests ways to remedy that particular interference.

The *Channel Master* Sleuth looks like a long, thick stick. It helps you identify electrical noise caused by engine parts. You connect the long cable of the Sleuth to the transceiver antenna socket. Plug a headset into the External Speaker jack. Turn the transceiver on.

Open the hood of the vehicle. With the engine running, point the Sleuth near various possible offenders—alternator, distributor, spark plugs, voltage regulator, and so forth. When the noise you hear increases, the Sleuth must be near a source of interference. Don't forget, there may be more than one.



What's called a *general-purpose noise filter* is actually a special coaxial (or feed-through) capacitor. They come in several ratings—20, 40, 60, and 100 amps. A few kinds are polarized—made only for a positive or a negative ground. They come in several shapes. What size and type you pick depends on where the filter goes. Low-amp types are for correcting noise caused by windshield wipers and fuel gauges. Heaters and air conditioners draw a bit more current, so you'd choose a heavier rating—say 40-amp. Larger 60-amp filters go with alternators, regulators, ignition coils, and the like.

These capacitors are called *feed-through* noise filters because they are added in-line. Voltage for the offending equipment actually passes through them. They suppress any noise impulses that the voltage wires carry or radiate. Hence, feed-through noise filters should be placed as close to the noise *source* as possible. They work well at the firewall, too, where the offending wires go through (you'll have good grounding there).

Lacking a sure diagnosis of the noise source, you could install a noise filter, as a stop-gap measure, at the back of the transceiver. Disconnect the transceiver from dc voltage and the antenna. Select a 20-amp filter with a mounting bracket. Fasten the filter body to a bolt or screw on the back of the transceiver. Remove the nut and washer on each end of the filter.

The filter goes in series with the positive (red) dc lead. Cut only the red wire, 4 or 5 inches from the transceiver.

Strip about 3/8 inch of insulation off the ends of both loose red wires. Crimp on ring lugs that fit the terminals of the filter. You could wrap the bare wires around the terminals, but that's sloppy; besides, lugs hold better. Add the washer and nut and tighten.

If this stop-gap filter doesn't head off interfering noises, you'd best set about finding where you need filters elsewhere in the system. If you can't, your technician can help.

Static-type noise interference typically stems from friction caused when vehicle body members rub against the frame. Often you're not even aware of the rubbing. But your radio detects tiny electrical impulses generated by the grating action. Even when the parts are bolted together, there is always some play or "give" between the two. The trunk lid and the hood are among the worst culprits. Friction occurs at doors, fenders, tailpipe, and under the vehicle where the body bolts to the frame.

Ground straps offer a simple solution. These 6- and 8-inch braided aluminum straps establish grounding continuity between two different points on the vehicle. The continuity prevents any static buildup, so there's no noise generated by intermittent discharges to ground (frame). Result: reduction in "rolling" noise in your two-way radio.

The hood area makes a good place to start. Use one strap on each side, to ground the front fenders to the main body section. One lug of the strap goes on the fender. The other end goes on the body frame. Leave as much slack as possible. Lay the strap in place and mark through its lugs with a pencil.

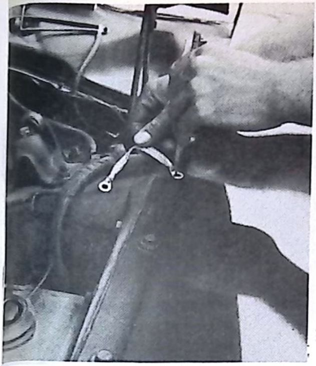
Centerpunch your pencil markings. It prevents drill slippage, making your work safer and speedier. Cover the centerpunch dents with masking tape. Push the tape into the indentation so you can see where to drill.

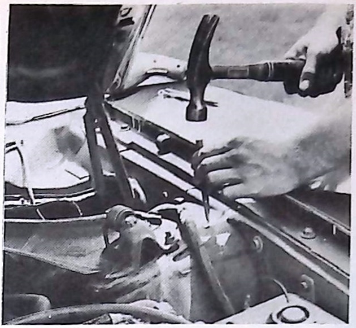
When both holes are drilled, remove the tape. Clean the surface around the holes with sandpaper. Remove grease, mud, goop, and *paint.* Get down to shiny metal; you won't have a true ground otherwise.

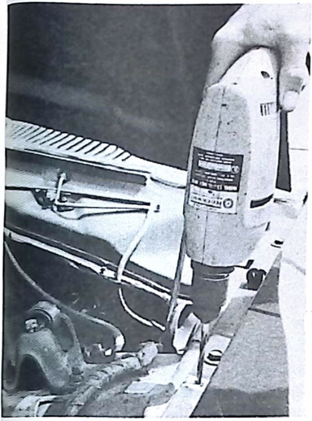
Secure both ends of the strap with heavy sheet-metal screws. Tighten well, but not enough to strip the holes. (Every few months, loosen and retighten these screws, to "clean up" their grounding action.)

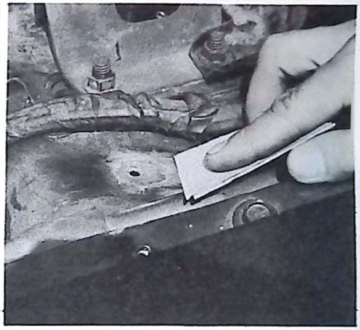
Grounding the fenders doesn't ground the hood. Use an 8-inch strap for that. Be careful that you don't drill into wires behind the dash-panel frame. Use a bushing to stop the drill bit as soon as it penetrates the metal. Beyond that, follow the same procedure as you did for grounding the fenders.

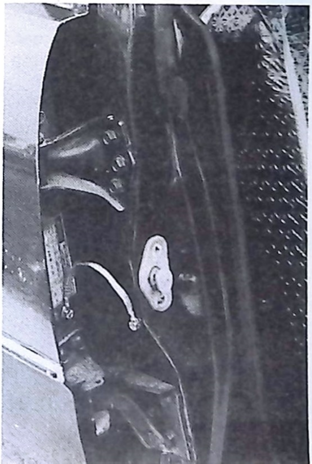
Ground straps you install in doorways, attach so they won't get pinched and cut. As with all ground straps, look for the most protected place to secure them. Sandpaper the paint off around the holes. And leave plenty of slack in the strap.











If you drive a vehicle that's two or three years old, you may put up with a whining noise in your transceiver. As your vehicle moves faster, or as you race the engine, the pitch of the whine grows higher. You're hearing the result of noise developed by the alternator. This whining can occur in a new vehicle, but it doesn't usually. After a few years, though, slip rings inside the alternators get worn or dirty. Their condition produces the whine.

Consider having the alternator serviced first. It's going to fail sooner or later from this defect. Afterwards, if you still hear the whining interference, install an *alternator filter.* It's a capacitor with a bolt-stud at one end and two wires at the other. One wire is heavy, coming from the center at the end of the filter. This wires goes on the output terminal. The second, thinner wire goes to ground. Here's how to hook it up.

Open the hood of the vehicle. Before you start working, disconnect the positive battery cable. Pull it well away from the terminal so it cannot touch inadvertently while you work.

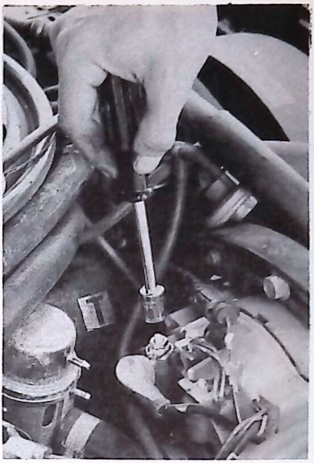
You need to get at the main output terminal of your alternator. It's at the rear, generally under a cable boot. Pull the boot off the terminal. With a ratchet or nutdriver, loosen the nut on the terminal. Remove the alternator cable lug from the output terminal.

About an inch or so away from the output terminal of the alternator you'll see the fan belt adjustment bolt. Remove the nut from it. With sandpaper, clean dirt and corrosion off the bolt and the adjustment bracket.

Attach the heavy wire from the filter to the output terminal on the alternator. On the opposite end of the filter, on the threaded stud, is a nut and washer. Remove them. Take the cable that originally went to the main output terminal and attach its lug now to the terminal stud on the filter.

For grounding, you can slip the ground-wire lug over the fan belt adjustment bolt. Slide the washer and nut onto the bolt, and tighten. Or, if there's a smaller bolt handy, as there is in the final photos opposite, make the ground connection there. Any good, solid ground near the alternator will do.

A mounting bracket comes with the alternator filter. It's usually superfluous as the main filter cable is very heavy and rigid. Once connected, the filter isn't likely to flop around much.



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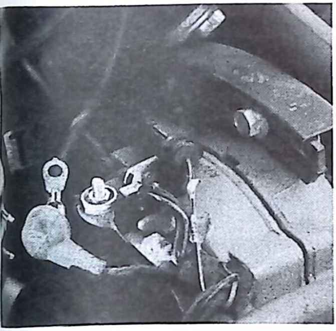
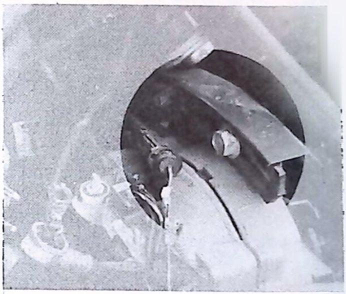
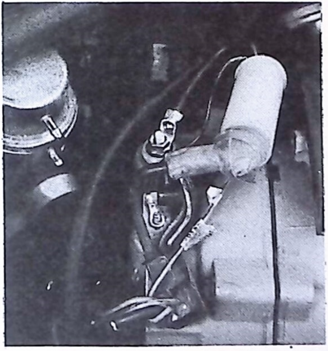
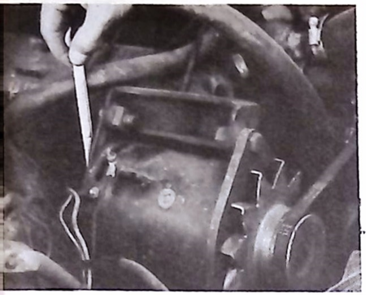
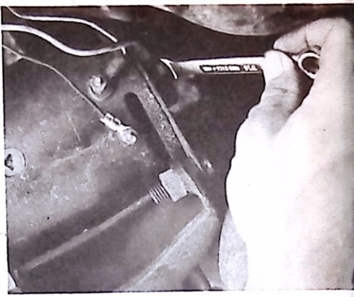










If your vehicle is older than a 1962 or 1963, you may experience a whine similar to that in newer vehicles. But your whine stems from a generator—older cars have those instead of alternators. Generators contain carbon brushes. When these brushes in a generator become worn, they produce electrical sparks as they rub the commutator segments. These sparks produce the whine your two-way radio picks up.

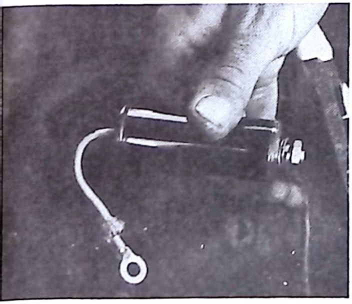
First, have old brushes replaced. Your generator probably needs new ones anyway. If the whine persists, ask a mechanic to check the commutator. If that's not overly rough, install a *generator filter.*

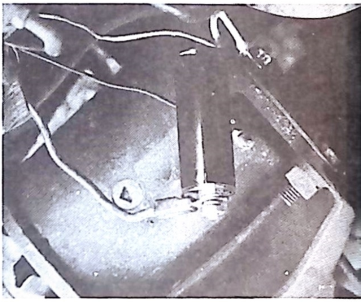
A generator filter has a threaded stud at one end, but only one wire at the other. The filter connects between the output terminal on the generator and the dc generator wire which connects there. The main terminal generally is at the rear of the generator. Remove the nut there and disconnect the wire.

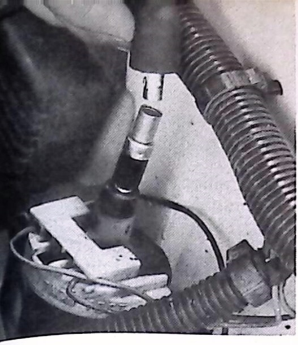
On one end of the filter you'll find a terminal stud with a washer and nut. Remove them. Slide the dc wire lug, the one you took loose from the generator, onto this filter terminal. Return the washer and nut, and tighten them.

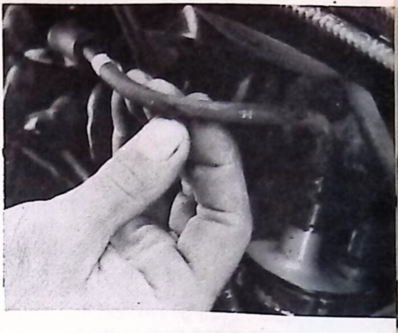
Now slip the lug on the filter wire onto the output terminal of the generator. Restore that washer and nut, and tighten.

Replacing the brushes and adding the filter should suppress most generator-caused interference to your communications.





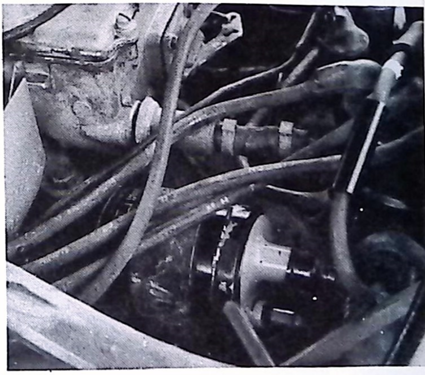




Some unavoidable noises originate with your engine's ignition system. Usually, this popping sound comes from the big coil wire. Long ago, metal cores in ignition wires were replaced by graphite. That cooled a lot of interference, but not all.

Old ignition cables with a wire center require an *in-line* suppressor. To install this kind, take out the cable that runs between the ignition coil center and the center of the distributor cap. With strong wire cutters, cut the wire into two pieces. The in-line suppressor has sharp-pointed screws inside both ends. Screw the cables into the suppressor ends, so the conductor in the center makes solid contact with the screws. When the suppressor is tight, reconnect the cable between the coil and distributor.

While the in-line distributor filter is inexpensive, so is a new graphite-filled distributor cable. If the filter doesn't correct the noise, try a new cable—perhaps with a plug-in type suppressor at the distributor, if necessary. But don't put an in-line suppressor in a graphite cable. It'll ruin your gasoline mileage (and end any hope of smooth idling).



You must think by now that almost everything on your vehicle can cause noise interference on your mobile radio. Maybe not everything—but a lot of things can. Spark plugs and their wires are no exception.

How do you recognize spark-plug or ignition interference? Turn on your transceiver and start the engine of your vehicle. Do you hear a rapid, sharp tapping, like someone dropping BBs on a pane of glass? Rev the engine. If the tapping speeds up as you rev the engine, like the BBs being poured, that's ignition interference. It's called impulse noise, because the spark discharges that make it are so sharp.

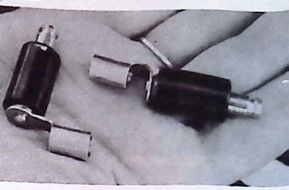
Before you go out and buy a suppression kit, take your spark plugs out and look at them. If the tips are corroded or fouled, put in new plugs. No amount of suppression will overcome noise from an ignition system that needs repair or replacement. If new plugs leave you with still too much noise, proceed with spark-plug suppression.

Spark plug suppressors come with a right-angle bend. The angle prevents arcing; it keeps the suppressor connection away from the engine. If the angle doesn't fit your engine, straighten it—but as *little* as you can do with.

Remove the boot from each spark plug. Push the suppressor onto the plug. Push the boot and wire onto the suppressor. Put suppressors on *all* the plugs. Install a plug-in distributor suppressor.

Retest your transceiver for noise. You'll notice the improvement. But don't expect to wipe out ignition impulses completely. You probably can't.

AUTO RADIO NOISE!!
NOISE SUPPRESSOR KIT
4.49



You can also use a feedthrough noise filter to suppress radio interference from the ignition coil. Open the hood of the vehicle. Disconnect both battery cables.

Look at the coil. It has two small wires and one thick cable. The cable goes between the coil and the distributor. Unplug it. Identify the two terminals on the coil—one marked BAT, the other DIST. Pull the boot off the DIST wire and unscrew the nut that holds it. So you'll remember which wire is which, wrap the end around the cable at the distributor cap. Disconnect the BAT (battery) wire from the coil too.

You'll have a hard time installing the filter with the coil where it's mounted. So remove the coil from its mounting. Keep the bracket too. Slip it off the coil and sandpaper an inch or so of the inside bare, opposite the mounting bolt.

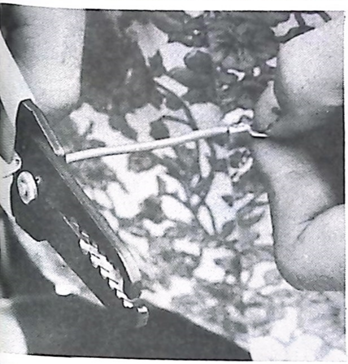
Notice that the bracket clamps around the coil very tightly. You may have to loosen it temporarily. Slide the mounting tab of the feedthrough filter under the coil bracket at the newly sandpapered spot. Now tighten the coil bracket to clamp the filter securely.

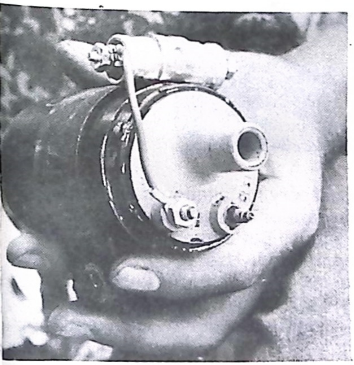
Cut a short piece of automotive electric wire, just enough to reach from one end of the filter to the BAT terminal on the coil, with a wee bit of slack. Strip 3/8 inch of insulation from both ends and crimp on ring lugs.

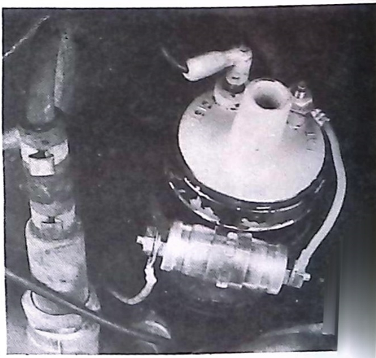
Push one lug onto the BAT terminal. Replace and tighten the washer and nut. Attach the other end to the nearer filter terminal, with that washer and nut.

Return the coil to its original place under the hood. Take up the original wire that attached to the coil's BAT terminal. Cut the boot off the end, strip 3/8 inch, and crimp on a ring lug. Attach this lug to the free terminal at the end of the filter. Return the DIST wire to its terminal on the coil. Plug in the heavy coil/distributor wire.

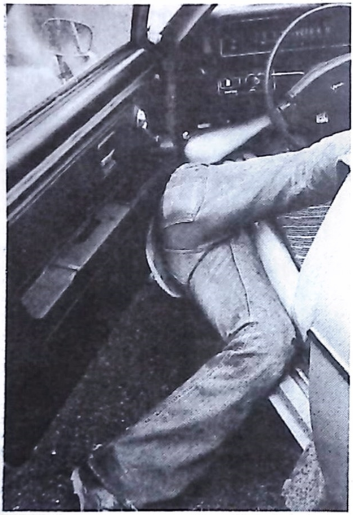
Realize that these new connections collect oil and grime. Eventually, it affects performance of the filter—and the ignition system. If you can find some, buy boots to cover the connections. At least clean them often.







As you can see, this bookful of accessories can help you build your two-way radio system from the minimal transceiver, mike, and antenna into a fully equipped, full-service communications station. No matter what form of two-way service you use, intelligent choice and application of accessories make your system better. True, some of the more sophisticated accessories need professional installation and maintenance. But for the most part, you can install these two-way radio accessories yourself. You might even say that you can do some of the installations standing on your head.



All the basic techniques for accessory installation have been included here. Some accessories were omitted and new accessories keep appearing in radio shops. But somewhere in this book you'll likely find something related. Use good common sense, and apply what you see here. Pretty soon your know-how will bring you and your two-way station envy and admiration. That and solid communications—what more could you want?

Easi-Guide to ACCESSORIES for ...CB ...TWO-WAY ...HAM RADIO

Sooner or later any user of two-way radio starts looking for something better. If you already have good equipment, the logical approach to improving your outfit is through accessories. But, which ones? This book describes the many accessories available, shows and tells you how to use them, and guides you in the selection of the right accessories for your own particular application.

Microphones and mike accessories that you can add to your rig are thoroughly described in Chapter 2. Next, auxiliary speakers that you can use to improve your listening are discussed. Chapter 4 tells you all about cables and connectors, and shows you how to make splices and add connectors. Then, complete instructions for installing a base-station antenna are given. Towers, rotors, roof and chimney mounts, switchers, matchers, and tuning are all covered. Chapter 6 is devoted to accessories for the base station, while Chapter 7 covers those for mobile stations, including ways to protect them from theft. The final chapter gives you a complete guide to locating and correcting noise and interference in mobile installations.

Forest H. Belt has become a major writer and photographer in the how-to fields. He has been teaching, writing, and lecturing since the mid-1950s. An electronics engineer, he served as editor for three major national magazines before forming his own group of writers, editors, consultants, and photographers. He flies planes, rides horses, and stays active in several other sports.

He has written and published nearly 500 magazine articles and over four dozen books. An article on his Easi-Read™ style of writing won him an award from the Society of Technical Writers and Publishers. Other volumes in this Easi-Guide series deal with Camping Comfort, CB Radio for Truckers, Citizens Band Radio, CB Radio for the Family, CB Radio in Recreational Vehicles, Multispeed Bicycling, and RV Maintenance. He has also written a book on CB repairs and troubleshooting entitled *1-2-3-4 Servicing Transistor CB & Two-Way Radio.* All are published by Howard W. Sams & Co., Inc.

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